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| Plants are essential to life on Earth.  Their autotrophic nature creates the base for food chains, through exposure to sunlight they create food insuring their survival as well as that of the animals on this planet.    We, as a human race rely quite heavily on the plants that inhabit the land with us for survival.  In turn these land plants, with the exception of ferns and bryophytes, rely quite heavily on seeds for their own survival.  Biologists suspect that plants evolved from a group of green algae called �charophytes�.  They believe that competition forced plants onto land where the plants evolved for their new habitat.  As well as making structural, transportation, and gas exchange adaptations, the plants also had to develop a reproductive system that would not involve water in fertilization or embryo dispersal.  The most advanced of land plants, gymnosperms and angiosperms, solved this problem with dependent gametophytes and the development of seeds (Campbell).    These seeds are convenient little packages containing an immature plant and enough food for its first few days of life.  These seeds are created in great abundance and carried away from the mother plant by animal, wind, water, or expulsion to land in new places.  There is no way of knowing where that place will be, perhaps it will be a gravel driveway, or somebody�s well maintained lawn, or maybe perfectly fertile and well-watered soil.  The plant has no insurance as to where the final destination of its seeds will be, many of the little embryos will never reach maturity, and only the fittest and the luckiest will survive.  Those that are adapted to the environment they land in will germinate and flourish.  It is because of this that many plants have seed adaptations that encourage advantageous placement of their seeds, or allow the seed to wait out harsh conditions and germinate only in an environment that is best suited for that particular plant.    Some plants develop attractive, tasty fruits to hold their seeds and encourage animals to eat the fruit and transport the seeds.  These plants insure proper dispersal by only letting the fruit reach attractive maturity when the seeds inside are also mature.  Other plant create hard fruits that are difficult for animals to open and are often buried to be opened later by the animal, this burial creates optimum growing conditions for the seed.  Plants that grow by water, and rely on an abundance of water for survival may drop their seeds into the water, which will disperse them somewhere along the banks of that body of water, thus putting them in an environment favorable to their survival.    Yet, for many plants after they reach their destination, conditions are not favorable, perhaps there is a lack of water, nutrients, or light.  In this case some seeds will wait it out until conditions become favorable.  Plant embryos, amazingly enough, can stay viable inside the seed for some period of time; the frozen seeds of an Artic lupine were planted and grew 10,000 years after they were buried by lemmings. (Northen).  This �seed hibernation�, called seed dormancy enables seeds to postpone germination until conditions for survival are favorable.  At this time germination may be triggered by temperature, water, light, or the breakdown of the seed coat.  For example, many seeds must endure a period of cold before they will germinate.  The soil of late summer may be quite moist and warm, encouraging germination, but the following winter would surely kill the young plant.  So plants like the spruce trees have adapted to combat this condition.  A spruce tree seed must be exposed to several months of low temperatures to activate chemical changes in the seed, which then allows the embryo to respond to spring growing conditions and when the seasons change the plant my germinate in a welcoming spring environment.  This phenomenon is referred to as �after-ripening� and is also active in many other plants like apple, lily, rose and dogwood (Northen).    Another interesting answer to seasonal germination is in seeds that are sensitive to the length of the day.  The amount of daylight that occurs during a twenty-four hour period is related to the season.  Plants like the *Begonia evansiana,* *Veronica persica,* and birch germinate in response to the amount of daylight in a day and so regulate germination to the season favorable to their survival. (Northen).    Other plants produce seed coats that are so hard they can only be cracked by the intense heat of fire.  In this way forest fires may split seed coats, which in turn induce germination and the repopulation of an area devastated by fire.  The new growing plants have fertile soil and the advantage of little competition.    Still other seed coats, are broken down by abrasive agents in their environment.  Water cannot pass through the tough seed coat, which is only made penetrable after contact with rough soil particles, frosts, water, and bacteria, fungi.  A simple break in the impenetrability of the seed coat will allow water to enter the seed imbibing it and starting the process of germination.  These tough seed coats stall the germination of the seed, and allow the embryo to sprout in favorable conditions far away from the competition of the parent plant. (Gibbons).    Many desert plants rely on a water-triggered germination for survival. If the short exposure to water that induces germination in other plants, caused desert plants to sprout, they would be doomed.  The light rainfalls that sometimes occur in the desert would not be enough to support the full life cycle of desert plants.  Only a good heavy rain will wash away the water-soluble, chemical inhibitors in a desert plant�s seed coat and allow germination of the seed. (Northen).    For some seeds the wait for germination is not a matter of environmental triggers, but only matter of time.  There are plants with volatile inhibitors that evaporate over time and when they have fully disappeared the embryo is allowed to grow.    The rate of germination for sweet clover is instrumental to its survival.  The little clover plant releases seeds that germinate after different lengths of time in order to insure that should a disaster befall some of the seeds others will be left to carry on survival. (Northens).  Some plants have germination that is staggered by such lengthy time periods as entire seasons. (Gibbons).  These special adaptations by plants in their seeds have allowed these amazing autotrophs to flourish.  Plants are rooted to the ground and cannot carry their young to places where their chance at survival is greater.  Yet every season new plants take root and reach towards the sun.  The little seeds survive incredible environmental conditions to continue the Kingdom Plantae, and so continue life on Earth.  Each little seed is invested with this incredible responsibility and in turn with incredible adaptations.  I decided I would like to explore one of these special adaptations that are so instrumental to life.  I decided to explore the importance of light in seed germination    ([Intro1](http://docs.google.com/introduction.html))([Intro2](http://docs.google.com/intro2.html))([Intro3](http://docs.google.com/intro3.html))([Intro4](http://docs.google.com/intro4.html))  [[Home](http://docs.google.com/home.html)][[Introduction](http://docs.google.com/introduction.html)][[Hypothesis](http://docs.google.com/hypothesis.html)][[Procedure](http://docs.google.com/procedure.html)][[Data](http://docs.google.com/data.html)][[Conclusions](http://docs.google.com/conclusions.html)][[Bilio/Links](http://docs.google.com/biblio.html)]  [[2002 Projects](http://docs.google.com/AP2002/index.html)][[2001 Projects](http://docs.google.com/index.html)][[2000 Projects](http://docs.google.com/AP2000/index.html)][[1999 Projects](http://docs.google.com/AP99/index.html)][[1998 Projects](http://docs.google.com/AP98/index.html)] |