Home Course In Modern Agriculture

I.—How a Seed Starts to Grow

By C. V. GREGORY,
Agricultural Division, Iowa State College

A SEED is a simple thing to look at. It might as well be a pebble or a grain of sand for all there seems to be to it. Only a bean, you say, yet there's a great deal more to that bean than you ever dreamed of.

Take a bean—just an ordinary white bean out of the pantry—and look at it. The smooth white outer covering is the seed coat. It is almost water tight and is a protection for the parts that lie within. On one side you will notice a very conspicuous spot. This is the seed scar and is the place where the little stem that fastened the bean to the pod was attached. Near one end of the seed scar, or hilum, as the botanists call it, is a small round hole, the micropyle. If you put a bean in water it will soon begin to swell because of the water which it absorbs through the micropyle.

Now, take a bean that has been soaked for a few hours. The seed coat will come off easily. The part of the bean that is inside is found to be split in two lengthwise. These two halves are called cotyledons, which is only another name for seed leaves. Spread the cotyledons apart carefully. If you look closely you can see a little plant tucked snugly away between them. Just to one side of the middle is a small stem, the caulicle. Fastened to it is the plumule, a tiny bunch of leaves so small that you may have difficulty in making them out. Farther on, at the end of the bean, is the stubby root, or radicle. These different parts are found in every seed, no matter how small.

FIG. I—A LITTLE BEAN PLANT.

Now that you have seen what is in the bean, examine a pumpkin seed in the same way. It is much the same inside as the bean, only flatter. The hilum is at the pointed end, and the plumule is so small that you may not be able to see it at all. In these two seeds there are only two main parts, the seed coat and the little plant. By far the greater part of the room inside the seed coat is taken up by the fleshy seed leaves.

Now let us look at a different kind of a seed. Take a kernel of corn that has been soaked for several hours and cut it in two lengthwise the narrow way. The back of the grain is made up in part of a hard, flinty substance and in part of a white, mealy layer. A large part of the front of the kernel is taken up by the soft, oily germ.

Look at the cut section of the germ carefully. The little plant can be made out very plainly. The little pointed stem which points upward and outward is the cotyledon. There is only one cotyledon in corn instead of two, as in the other seeds you have examined. If you will take a cotyledon of a corn plant that has been left in a warm place until it has commenced to grow and cut it in two lengthwise you will see that the inside is packed with layers of tiny leaves ready to unfold as soon as their turn comes. This is the plumule. The other parts of the little corn plant you will be able to make out with little trouble.

You have doubtless been wondering what the rest of the kernel, the part back of the germ, is for. While it is not a part of the plant itself, it is of very great use to it, as we shall see. The little plant when it begins to grow must have food. At first it has no roots to get this food from the soil, so it must get its nourishment from some other source. This source is the part of the kernel outside of the germ itself, or the endosperm. In the pumpkin seed and the bean the endosperm and the cotyledons are the same—that is, the food material is stored in the large, fishy seed leaves.

This food material consists largely of starch and oil. Neither of these can be used by the developing plant without first being changed to a liquid form. This is one of the reasons why seeds will not germinate without water. The other reason is that the water is needed to soften the seed coat so the plant can get out. But this starch and oil will not dissolve in water without first being changed to a soluble form. This is accomplished by means of ferments called enzymes. If you will put a piece of starch on your tongue for a moment you will find that it will begin to taste sweet. This is because the ferments in the saliva are changing it to sugar. The enzymes in the endosperm work in much the same way, changing the starch and oil to sugar and other soluble substances. These are dissolved by the water and go to feed the growing plant.

These enzymes cannot work without air and warmth. You already know that a seed will not germinate in cold ground, and if you will put some beans in a glass of water and leave them for several days you will find that they will not germinate, no matter how warm they are kept, because they cannot get air. The reason is that without both air and warmth the enzymes cannot prepare the food for the plant, and if it cannot get food of course it cannot grow.

After the plant has started to grow the seed coat is no longer of any use to it. In some plants, such as corn, the little plant finds its way out very easily. The little pumpkin plant, with its heavy coat, has a harder time. Indeed, were it not for a little contrivance with which nature has provided it it could not get out at all. This is a tiny hook on the lower end of the seed. This hook catches on the end of the seed coat and peels it back as neatly as you take off your coat. Watch for this in a germinating pumpkin or squash seed and see if you cannot notice it. In some seeds, like hickory nuts, the plant is unable to get out until the seed coat is cracked by the frost or in some other way.

We have seen that a seed cannot start to grow unless it has moisture, warmth and air. It not only needs these, but it needs them in the proper proportions. In a light, sandy soil moisture is often lacking, and the seed is slow in germinating for this reason. In such a soil growth will start more quickly if the soil is packed tightly around the seed. The seed will soak up moisture more rapidly if the particles of soil are in close contact with it on all sides. Packing down the soil in the row with the flat side of a hoe or with a board or with the broad, flat planter wheels in the field helps the seed to absorb moisture and so hastens germination.

In a heavy, sticky clay soil there is usually plenty of moisture, but air is often lacking. If such a soil is packed down too tightly over the seed the particles are forced so closely together that very little air can get through, and hence germination is delayed. In a soil of this kind seeds should never be planted very deeply.

The most important factor of all is warmth. A cold soil may have moisture and air in exactly the right amounts, and still the seed will not start to develop. Even if it does begin to grow progress will be slow, and the plant will have a weak, unhealthy look. It is of the utmost importance to wait until the seed bed is warm before planting the seed. Many seeds which would rot or produce only spindling stalks if planted in a cold soil will grow into strong plants if planting is delayed until the soil has become warm. Any seed will make a stronger, better producing plant if it has a warm seed bed to start from.

The rapidity with which soil will warm up in the spring depends a great deal upon the nature of the soil itself. A sandy soil warms up quickly because the air can get down into it easily, thus warming it all the way through at once. Another reason for the higher temperature of sandy soil is its greater dryness. As long as water is evaporating rapidly the ground will be cold. The process of evaporation requires a great deal of heat.

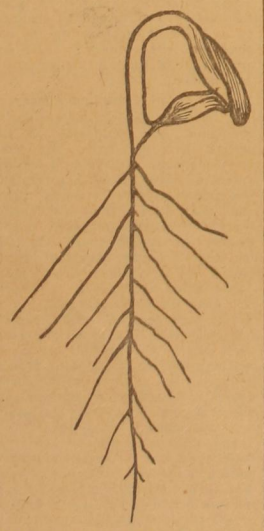

FIG. II—HOW A SQUASH PLANT TAKES OFF ITS SEED COAT.

We can help the soil to become warm in the spring, then, by doing all that we can to check evaporation. Did you ever notice how quickly the surface of a wet field became dry after it had been harrowed? This is because stirring and loosening the soil stops the water from coming up from below. The water in the loose upper layer soon evaporates, and after that the heat is used in warming the soil instead of turning the water into vapor. Of course if we are not going to allow the surplus water to be given off by evaporation we must provide tile drains and ditches to carry it away. We shall study more about drainage and the movement of water through the soil in another article.

HER COUSIN AGATHA

She Was Dashing and Handsome With Many Moths Fluttering About Her.

By GEORGE MUNSON.

Sylvia Blaine was happier than she had ever been in all her life before. But when one is nineteen happiness comes easily, especially when one is in love.

Tom Darragh was generally considered the most promising young lawyer in Stapleton. The Darraghs and the Blaines had been members when Stapleton was only a tiny hamlet; old Mr. Darraugh had returned to the city of his birth to end his days there, and Tom had gone into a lawyer's office. Now at twenty-seven he had a flourishing business. And he loved Sylvia Blaine.

Sylvia could not believe that it was right for any girl to be as happy as she was. And why should Tom have chosen her when there were so many sweet girls of his acquaintance? If he had ever known her cousin Agatha, for example, she was sure that Tom would never have looked twice at her.

Agatha Blaine was five years older than Sylvia. Although she had been born in Stapleton, she had not lived there much during her checkered existence. She had made an unhappy marriage and was suing the man for a divorce. Agatha was a handsome blonde—"dashing," people called her—with any number of moths fluttering round her. And the worst of it was that Agatha, who could never resist making conquests, was coming to stay with Sylvia's mother.

How could the little country girl retain her influence over Tom when handsome, rich, citified Agatha was there?

"Why, you foolish child," said Tom laughingly, when Sylvia voiced her

Suddenly She Stopped.

fears, "don't you know that I am madly infatuated with you? Bring on your Agatha and watch me."

Sylvia sighed and suffered Tom to kiss the incipient lines of trouble off her pretty forehead. But when Agatha did arrive, a resplendent being in a picture hat, with four trunks and a pedigreed dachshund, she was more than ever convinced that her days of happiness were numbered.

Agatha was so kind that the girl half minded to confess her trouble to her. But Agatha seemed also a little heartless. Sylvia was bound to confess that as she sat with her and her mother and watched the elder lady's eyebrows gradually contract as she listened to their visitor's flippant comment on men and events. But doubtless it was Agatha's unhappy matrimonial experience that was responsible for that.

"Why, my dear auntie," she said to Sylvia's mother, "what funny, old-fashioned ideas you have about men. Any woman can twist any man round her little finger, if she chooses."

"I wonder if she will choose to twist Tom round her little finger," sighed Sylvia to herself, when Agatha congratulated her warmly. Her interest in the engagement seemed almost unnatural, and she insisted upon purchasing a large part of Sylvia's trousseau. She also inquired into the condition of Tom's finances, and when she learned that his home would have to be a very modest one she seemed quite distressed.

"And I have more money than I know what to do with," musingly. "Richard settled $40,000 on me when we were married, you know."

On the day after her arrival Tom was introduced to her. Sylvia, watching them closely, although she assumed an indifferent manner, felt that her worst fears were confirmed. Within a few minutes after the introduction they were chatting together like old friends.

"Well, I've seen this wonderful Cousin Agatha," said Tom, as they parted, "and she can't hold a candle to you, sweetheart." But Sylvia detected a note of insincerity in his voice, and that night she cried herself to sleep.

The next day Cousin Agatha pleaded a headache when Sylvia broached the proposition of a walk. Sylvia had some shopping to do, and, after a stroll through the woods alone, returned through the village. Suddenly she stopped dead; she felt as though an icy hand had been laid upon her heart, for at a window on the second story of some business offices she saw Agatha's hat.

There was no mistaking that hat. There could not possibly have been another like it in Stapleton. And the irony of the situation lay in the fact that the hat was nodding at the window of Tom's office.

There were few people in the street, and nobody noticed Sylvia clinging, with pale face and trembling limbs, to a corner of the building opposite. She could not tear her eyes away from what she saw. And a moment or two later she saw Agatha's filmy lace handkerchief pressed to her eyes, saw Agatha's head bowed upon her hands, and saw Tom's hand patting her cousin's shoulder consolingly.

After awhile Sylvia summoned strength to go home. She did not tell anybody what she had seen. She wrote a little note to Tom that evening.

"I find that I made a mistake," she said. "I thought I loved you, Tom, but I was wrong. Please do not call or write to me, and never ask me to explain."

She knew Tom was too proud not to take her at her word. And the next two weeks were miserable ones, for she herself was too proud to let Agatha know how she was suffering.

"Well, I must say I don't think much of that Sweetheart of yours, Sylvia," said Agatha. "If I were engaged to a young man I should expect him to come to see me every evening. And here it must be a couple of weeks since he has put in an appearance."

Sylvia did not make the retort that was upon the tip of her tongue: That on four separate occasions she had seen Agatha in Tom's office. And when her mother, looking at her searchingly that night, asked her whether anything was wrong between Tom and herself, she denied it miserably and hurried to her room, that she might give way to her tears without restriction.

But everything draws to a close, and the time was come for Agatha to leave. The four trunks were packed, the wonderful hat went into a special box, giving place to a neat traveling hat, and Agatha was waiting for the carriage to come to convey her to the station.

"Sylvia, dear," she said, "there isn't anything wrong between Tom and yourself, is there?"

"N-no," stammered Sylvia brazenly. She would never give her cousin the satisfaction of knowing the harm that she had wrought.

"Because," said Agatha, "I wouldn't have engaged his services if I had reason to believe he was going to be unkind to you."

"Engaged his services, Agatha?" asked Sylvia, bewildered.

"Yes, dear. You know I didn't like my lawyer, Wagstaff, who, between ourselves, hadn't been quite straight with me. So I thought: Here's $500 worth of law business going begging, and why shouldn't Tom Darragh have it and be able to start housekeeping with a nest egg in the bank? Only, I'm afraid he must think me a dreadful goose, Sylvia. Because, the first time I went to his office I began contrasting him in my mind with Richard, and thinking what a lucky girl you were—and I just broke down and cried. Why—Sylvia!"

For Sylvia was crying, too, and when the cab arrived she had only just begun to explain. She was so remorseful that she did not notice the direction which the cab was taking until it stopped outside Tom's office. And then—

"I can't go in, Agatha. I dare not. I'll write to Tom—"

"Well, now, you just sit still and I'll bring Tom out to you," said Agatha sternly. And when, a minute later, the door opened and Tom came in, Sylvia clung to him, sobbing and repentant.

"O, Tom, what a goose I was. Can you ever forgive me?" she asked.

"On one condition," he answered. "That you marry me next month."

"On one condition," said Sylvia docilely.

"Which is—?"

"That Cousin Agatha shall be bridesmaid."

Oxygen and Breathing.

That there is less oxygen in the rarefied air of celebrated mountain health resorts than in any room with closed windows, no matter how crowded with persons, was an unchallenged statement made in the Times by the English expert on ventilation, Dr. Leonard Hill. The British Royal society has just published a prayer supplementary to the report on the Anglo-American Pike's Peak expedition by Miss M. P. Fitzgerald, which concludes with the statement that "arterial blood contains considerably more oxygen at high altitudes than at sea level." The lungs are better ventilated, for one thing, but it is certain, also, that the old theory that the lungs should be plentifully supplied with chemically pure air must be discarded. The little cell-like alveoli at the ends of the lung branches have a special power of extracting oxygen, even while the supply of oxygen in the air is deficient. This secretory power is increased at high altitudes, and the increase does not disappear until a considerable time after descent to sea level.

His Sketch.

A youngster in school was busy drawing. The teacher, to appear interested, approached him and said kindly:

"Well, Johnny, what are you drawing?"

"Why, I was making a picture of you, but it didn't look enough like you, so I put a tail on it and called it a dog."

Who is the chief justice of the supreme court of the United States, and what annual salary does he draw?

The chief justice of the United States supreme court is Edward D. White of Louisiana, who was appointed in 1910. His annual salary is $15,000.

Is a new star added to the American flag as soon as a state is admitted to the Union?

No; not until the Fourth of July following the president's proclamation of admission. This rule was fixed by a law passed in 1818 and has been followed without exception since.

Which is the oldest national flag now in use?

The American, the design of which remains the same as it was adopted June 14, 1777, except for the addition of a star for each state when admitted. The design of the present flag of Great Britain was adopted in 1801, that of France in 1794, that of the German empire in 1871, that of Italy in 1848.

Was the office of poet laureate of England ever declined by any person to whom it was offered?

It was declined in 1757 by Thomas Gray, author of the celebrated elegy, and by Sir Walter Scott in 1813. Wordsworth before accepting the office stipulated that no formal effusions should be considered a necessity.

How many cubic inches are there in a gallon, and what is the weight of a gallon of water?

The standard gallon of the United States contains 231 cubic inches and 8.33 (eight and thirty-three hundredths) pounds of distilled water. The English imperial gallon contains 277 cubic inches and ten pounds of distilled water.

Tell me the estimated number of followers of Islam at the present time?

There are nearly 200,000,000 Moslems. The Turkish government has officially estimated the number at 176,000,000, divided as follows: Turkish domination, 18,000,000; other parts of Asia, 99,000,000; Africa, 36,000,000; other countries and the islands of the eastern seas, 23,000,000. Some estimates are larger. By census of 1901 British India alone contained 64,458,000. Mann in 1900 gave the following figures: Malay archipelago, 31,042,000; China, 32,000,000; Africa, 80,000,000; total, 200,313,845.

What race founded the ruined city of Baalbek?

Syrian sun worshipers.

What day did Lent begin this year?

Wednesday, Feb. 5.

Who wrote "The Soul Here and Hereafter," and is the author still alive?

Charles Marsh Mead. Died February, 1911.

Did the late Dr. J. F. Koch discover the germ of tuberculosis? Did he finally conclude that animal tubercular germs could give the disease to human beings or not?

We are unable to find out anything about a Dr. J. F. Koch. The late Dr. Robert Koch, the distinguished German bacteriologist, was the discoverer of the tubercle bacillus and the first to isolate the specific germ. He made this discovery while a member of the imperial health board of Berlin and announced it to the medical world in 1882. In 1901, at the British congress for tuberculosis held in London, he announced that bovine tuberculosis and human tuberculosis were distinctly different diseases. These statements gave rise to extensive disputation and experiment. In 1908, at the international tuberculosis congress held in Washington, at which Dr. Koch was elected honorary president of the association by reason of his distinguished researches, he again announced it as his opinion that bovine and human tuberculosis were entirely different diseases. This opinion was combated by practically every expert of note at the congress, and today it is almost universally conceded by the medical world that Dr. Koch's theory was incorrect.

Is there any demand for brick clay? If so, where could one find a market for it?

The demand for brick clay depends upon the building activities of the cities and towns nearest you. It would not pay to ship it except in its finished form—i. e., bricks. The shipping facilities, both by rail and water, and the extent of the clay deposits on your land would also have an important bearing in determining the question of a market, for it would be necessary to build kilns and provide for the transportation of the finished product. This could not be done profitably unless these deposits are sufficiently extensive and the freight rates low enough to make competition with other brickmakers possible.

What state produces the most tobacco?

Kentucky produces more than one-third of the entire crop of the United States.

How do the sexes compare as to numbers in the United States and England?

According to the latest figures obtainable, in the United States there are 2,692,288 more males than females, while in England and Wales there are 1,179,276 more females than males.

HER LETTERS TO DAD

By ELEANOR G. REESE.

Brighton Casino, Atlantic City, March 8, 19—. Dear Dad: What an everlasting age it seems since I left you and Ted standing on the platform, waving good-by to me! I cannot believe that this place is going to do me much good when I think how long the weeks will be before I will be back in dear old Gretna, but I shall try hard to grow strong for your sake.

"Aunt Helen is very still, very plain, and very much a 'Quaker lady' but I like her immensely, for she leaves me so much alone.

"Today I am curled up in one of the big wicker chairs at the Casino, tramping along, or being pushed in those queer chairs—for all the world like a colony of ants moving to a new hill.

"And then, dad, there's the sea—not blue like the books always have it, but an angry, foaming, grey-green sea, rolling its great waves up on the beach where they break and thunder at our feet. Tomorrow it may be calm enough, but today it suits my mood, and I love it.

"The orchestra is playing the 'Traumerei'—oh, dad, those days in Florence come back and I dream such dear idle dreams!

"You will come to me, soon, dad dear, for I'm desperately lonely without you. Ted can manage the ranch for a little while.

"Give my love to Ted, and to everybody, but keep for yourself the dearest love of your girl, Jean."

"Brighton Casino, Atlantic City, March 11, 19—. My Own Dad: Thank you for your good, breezy, loving letter; I could almost imagine myself home again. The days have gone by somehow and I shall look for you before long—don't disappoint me!

"If only the old sorrow would bury itself deep down in the sand I might promise to come home happy and care-free again, but it won't leave me, dad. If you knew how I've tried to be glad that I sent him away!

"I sit here morning after morning and watch the ships far out on the horizon-line, and long to be on one of them sailing away to Italy—and Ralph. What if he is doing his duty, what if I did send him away, he is as truly mine—no, no, dad, he isn't, I'm all wrong! It is seeing so many happy people that makes my loneliness unbearable. By now he is married to that little girl in Italy—I hope she'll love him lots.

"There dear, forgive me, I would not pain you, you, who, are so patient with me! Soon I will be home and I will try harder to be brave. Heaven knows you need all the sunshine I can give you! Don't think me ungrateful, but love me, dad, for you're all the world to your own girl, Jean."

"P. S. Kiss Ted for me, he's the dearest sort of a brother!"

"Hotel Brighton, Atlantic City, March 15, 19—. Dad Dear: Something has happened! After all the dark days I am to be happy, dad, do you hear me? Happy! I was sitting in the Casino yesterday morning with my back turned to the crowd when I heard a woman's voice say: 'There he is, now, isn't he interesting looking?' I did not turn around but some one drew a chair near mine and sat down to read. I read a long while, until the place was quite deserted except for this stranger who had his back to me. Suddenly, he throw down his book, walked over to the window and began to speak, evidently supposing himself quite alone. At the first sound of his voice I kept very still in my chair. 'What will it all come to?' I heard him say. 'I have done all I could, but even for her dear sake I cannot marry another woman. In Heaven's name why should I? It would all be a damnable lie from beginning to end, there would be no peace here nor hereafter. Ah, Jean, Jean, if I had never looked into your great, soulful eyes, if my arms had never held you close, it might have been, but now—never! You said you would not marry a man who had idly won another womans' heart. You meant to do right, little girl, but you did not know how despicably deceitful she was, and I can never tell you.'

"It was then that my purse dropped loudly to the floor. With an angry exclamation he stooped to pick it up for me, not looking at my face, but as he handed it to me, I held his hand fast, and oh, dad, if you'd seen his eyes when he looked and saw it was I! He started to take me in his arms, but, remembering our parting, he straightened himself up and begged my pardon, said he supposed I knew he had not done what I sent him to do, and then said he would leave. I couldn't stand that, dad, so I just asked him if he hadn't been away long enough—you can guess what his answer was!

"P. S. You should see Aunt Helen! She does not yet believe Ralph is anything more than a board-walk acquaintance, and we have such fun with her. Won't it be glorious when you come and tell her all? Jean."