obtain a balance is decreased, and hence the apparent "capacity" of the cell is increased; (4) the higher the apparent "capacity" of the cell, the smaller the change of resistance with change in frequency; (5) solutions of different salts having about the same resistance in the same cell give approximately the same change in resistance with change in frequency from 600 to 1,000 cycles.

By comparing the resistances of $N/10$ and $N/20$ NaCl in two cells, one of which had bright and the other platinized electrodes 1 inch in diameter, it was seen that the ratio for the cell with bright electrodes was much lower than that for the cell with platinized electrodes, but as the frequency was increased the ratio for the cell with bright electrodes approaches that for the cell with platinized electrodes. Extrapolating the resistance for the cell with bright electrodes to infinite frequency, the ratio was found to differ by only 0.01 per cent. from that given by the platinized electrodes. It is thus shown that the true electrical resistance of solutions can be measured or calculated in cells with bright platinum electrodes only at infinite frequency.

Saturation of bright and platinized electrodes with hydrogen produces no appreciable change in the "capacity" of the cell at 60 cycles. This and much other evidence seems to show that the "capacity" does not arise from a neutral gas layer deposited on the electrodes and acting as an air condenser. It is probably due to a "double layer" of the electrolyte and the "contact potential" arising from changes of concentration resulting from electrolysis and to the reverse electromotive force coming from the deposition of ions on the electrodes.

The inductance necessary to balance the "capacity" of the cell is nearly but not quite inversely proportional to the square of the frequency. As this relation holds true for a "leaky" condenser the cell seems to act as a simple condenser with a "leak."

As the frequency of the alternating current is increased the change in resistance of a given solution in a given cell, and also the inductance necessary to balance the capacity of the cell, are decreased, and both approach zero at infinite frequency. The ratio of the difference in the inductance in millihenries to the difference in the resistance in ohms between 600 and 1,000 cycles has a constant value of about 2.00.

Mr. Henry P. Hastings is continuing the work by making measurements of resistance, capacity and inductance at much wider range of frequency, namely, 60, 250, 500, 750, 1,000, 1,500, 2,000 and 3,000 cycles. He has confirmed the fact that a change in frequency produces a change in inductance necessary to balance the cell capacity which corresponds fairly closely to the equation $KL = 1/Cw^2$. At lower frequencies he observes easily a third harmonic produced by the cell. Mr. Hastings has also confirmed our work by extrapolating the resistances of solutions in cells with bright electrodes to infinite frequency and showing that they approach the values given by the same solutions in cells with platinized electrodes.

He has also found that the ratio of the *change of resistance* which is sometimes 5 per cent. of the resistance, to the *change of inductance* produced when the frequency is changed is approximately constant.

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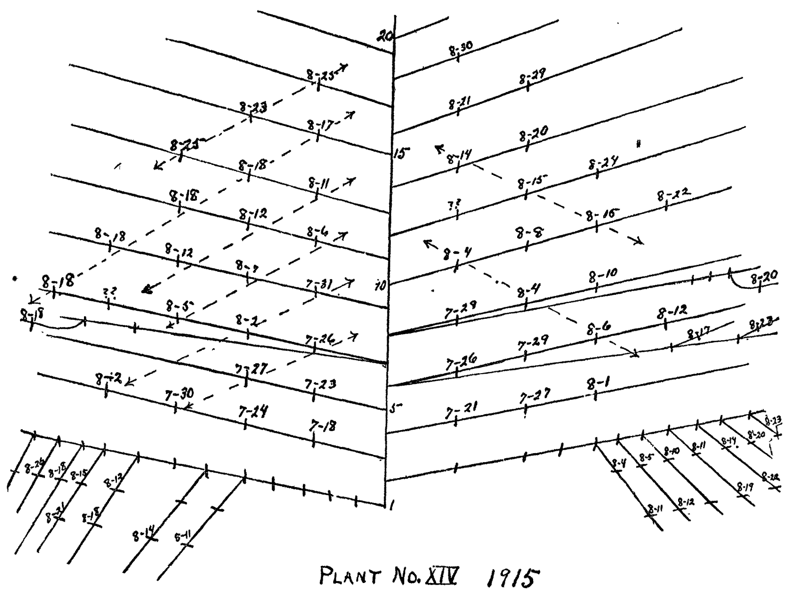
ON THE REGULARITY OF BLOOMING IN THE COTTON PLANT

In 1915 the writer carried on some experiments on the water requirement of cotton, in connection with which the blooming records of a number of plants were kept. In looking over these records, there appears to be a sort of regularity in which the blooms opened and two of these records which showed the greater regularity are herein given.

To those unacquainted with the habit of growth of the cotton plant it will be well to first call attention to the different kinds of branches as shown on the accompanying diagrams. On the one of plant No. XIV., those branches numbered one and two are known as vegetative branches; these occur on all plants of this species so spaced as to have freedom in growth but are often aborted when the plants are crowded, much as are the lower branches of trees in a crowded forest. From each node of these branches secondary fruiting ones grow in a similar manner as do the primary fruiting branches from the main stalk, although the inner ones may be thrown off on account of the dense shade, as will be noted from the diagram.

strength of the plant will be thrown into the fruiting ones and a greater and earlier crop will result.

Out from nodes number six, seven and eight, will be noticed some secondary vegetative branches; from these also fruiting branches occur as from the primary. On small plants, dwarfed from lack of water or of plant food, these are usually wanting but may occur on



PLANT No. XIV 1915

Fig. 1. Plant No. XIV.

Above the vegetative branches, coming out from nodes three to eighteen are the primary fruiting branches. The bolls on these are larger and earlier than those found on the secondary fruiting branches mentioned above as well as on those yet to be mentioned; from the complete record of this plant it was noted that seventeen bolls opened on the primary branches before any opened on the secondary. Farmer's Bulletin No. 601 explains a new system of cotton culture which is based on this fact and on that of the abortion of the vegetative branches, mentioned in the preceding paragraph. The claim is made that with thicker planting, late thinning, and by leaving more plants per acre than is usually done, the vegetative branches will be aborted, the plants having good conditions of environment or may come out as a result of topping or other injury to the plant. The diagram shows no true branching of either vegetative or fruiting branches. Mr. O. F. Cook in Bul. No. 198 of B. P. I. says:

> Pruning or other injury, or renewed growth in late season may cause the formation of secondary limbs from primary limbs, or even from axillary buds of fruiting branches.

He further points out that vegetative branches ordinarily arise from axillary buds and fruiting branches from extra-axillary ones. For other variations in the branching or in the location of the flower bud, the reader is referred to this publication. In these diagrams, the branches are shown necessarily as alternate, although occurring on the plant in a spiral.

On the main fruiting branches, there appears normally a single bloom at each node. In the diagram of plant No. XIV., it is shown that the blooming began on the third branch (first fruiting branch) on July 18 and ended on the eighteenth branch on August 30. The intervals between the blooming of the first nodes on consecutive branches varied somewhat, but averaged about three days. The time between blooms on any given branch was approximately double the time between the "vertical" blooms, as given in the preceding sentence. This relation was carried out with the other blooms on any given branch. To put it in other words, *there is an apparent relation,* indicated by the broken arrows on the diagrams, *between the blooms on any one branch and those on the second higher one, in that any given bloom has a tendency to appear at the same time as the one on the second higher branch, one node nearer to the main stalk.*

This regularity occurred on plants of the Cleveland Big Boll variety, grown in potometers. Plant No. XIV. was grown in soil the water-saturation of which was maintained at 90 per cent. Plant No. XXIV. was grown in soil the saturation of which was maintained at 60 per cent. and shows even more than the other this regularity in blooming.

Conditions of environment, such as the water content of the soil, the amount of available plant food, the day and night temperatures, sunniness or cloudiness, theoretically would influence the length of time which exists between blooms and variations in these should cause variations in blooming in plants subjected to the varying conditions; there exists also, no doubt, a difference in different varieties as to the rapidity with which they bloom, but granting this, it is likely that the relation which is pointed out would even then very likely hold true.

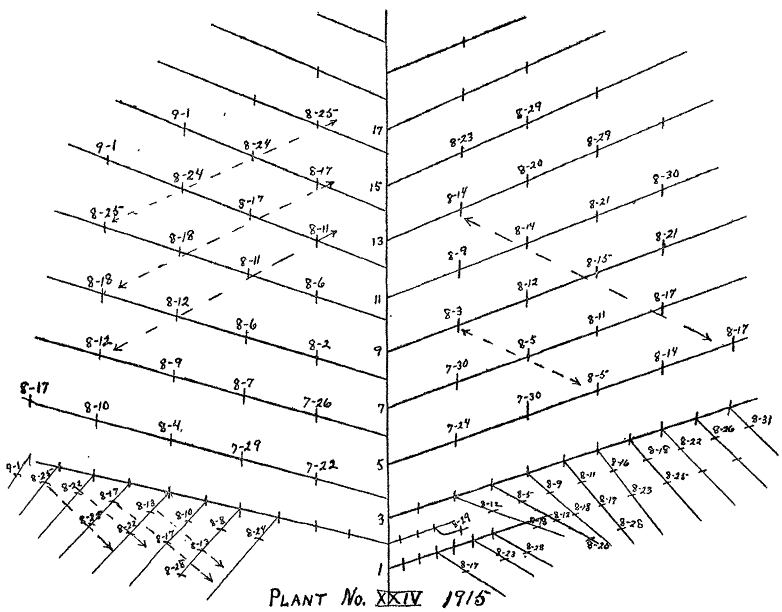


FIG. 2. PLANT No. XXIV.

As stated, these diagrams are of the two plants which show the regularity to the greatest degree. They show also many instances in which the bloom appeared not on the same day, but one day later than on the second branch above and one node nearer to the main stalk. Then there are many examples showing great irregularity. It would seem that this points to a very interesting field of study on what is the *order of blooming* in the cotton plant, the normal *time between blooms* both vertically and horizontally, the *inherent tendencies* toward regularity or irregularity of different varieties, and the factors which influence or determine these things.

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THE SAN DIEGO MEETING OF THE PACIFIC DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE first annual meeting of the Pacific Division of the American Association for the Advancement of Science was held in San Diego, California, between the dates, August 9 and 12. The headquarters for the meeting were maintained in the U. S. Grant Hotel, and the three evening sessions of the meeting were held in the assembly room of the hotel. For the day sessions of societies participating in the occasion convenient meeting places were provided in the San Diego High School by courtesy of the Board of Education of San Diego.

The first of the general sessions of the San Diego meeting was held on Wednesday evening, August 9, Dr. W. W. Campbell, president of the Pacific Division, presiding. Hon. Lyman Gage, of San Diego, spoke in welcome on behalf of the citizens of San Diego, and Dr. D. T. MacDougal, chairman of the executive committee of the Pacific Division, responded on behalf of the Division. These addresses were followed by the address of the president of the Division, Dr. W. W. Campbell, director of the Lick Observatory, Mount Hamilton, upon the subject, "What We Know about Comets," illustrated by stereopticon. After this session a reception, given under the auspices of the honorary reception committee for the San Diego meeting, was tendered to the visiting members of the American Association and of other societies participating in the meeting.

The second general session of the Division was held on Thursday evening, August 10, Dr. D. T. MacDougal, chairman of the executive committee of the Pacific Division, presiding. At this session the executive committee of the Division was reelected to serve for the ensuing year, upon nomination by a duly appointed nominating committee. The members reelected at this time were:

E. C. Franklin, professor of chemistry, Stanford University.

T. C. Frye, professor of botany, University of Washington.

C. E. Grunsky, consulting engineer, San Francisco.

G. E. Hale, director of the Mount Wilson Solar Observatory, Carnegie Institution of Washington, Pasadena.

V. L. Kellogg, professor of entomology, Stanford University.

A. C. Lawson, professor of mineralogy and geology, University of California.

E. P. Lewis, professor of physics, University of California.

These seven elected members, together with the president and the vice-president of the Division, elected by the committee, constitute the executive committee of the Division.

Following the transaction of this business, an address was given upon the subject, "Modern Natural History Museums, and their Relation to Public Education," by Dr. Barton W. Evermann, director of the museum of the California Academy of Sciences, San Francisco. This address was illustrated with stereopticon views of animal habitat groups which are being installed in the museum of the California Academy of Sciences.

The third general session of the Division was held on Friday evening, August 11, Dr. W. W. Campbell, president of the Pacific Division, presiding. At this session the following resolutions, presented by the Western Society of Naturalists, were unanimously endorsed:

IN VIEW OF THE FACT that the great natural resources of the sea in this part of the world, long known to naturalists, are beginning to be utilized; and

IN VIEW OF THE FACT that these developing industries, notably those of tuna fishing and kelp harvesting, are making conspicuous many problems of great interest, both industrial and scientific, the solution of which is possible only by long and somewhat expensive investigation;

Resolved, that the Western Society of Naturalists urges upon the attention of the government of the United States and the state of California the importance of giving such support, financial, legislative, administrative and otherwise, as may be necessary to place the various sea industries on a thoroughly scientific foundation; and

Resolved, that a committee of five, four from this society and one from the industries be appointed to act in cooperation with other representatives of the industries for the furthering of the ends indicated in these resolutions.

Resolved, that these resolutions be presented to the Pacific Division for its consideration with the hope that its approval may be given.

Following the business of this session an address was presented upon the subject, "The Physician of To-morrow," by Dr. F. F. Wesbrook,