suppose, the thermometer would be effect-
ed at that distance to the windward?

A member: Fire would do it, that is per-
fectedly probable.

Mr. Montgomery: Can a man protect
his grove in the same way in Florida?

Mr. Wright: I have no doubt in my
mind at all, but you have got to have sever-
al fires to the acre. I don't say there was
but one fire, but the nearest fire was over 70
feet from the thermometer and there was
that difference. I give it as I read it, and in
connection with the investigation I had
been making with fire as compared with
smudge heat, I find it wont do to rely on
the smudge under all circumstances, that
fire must take its place. I believe that you
can protect your grove by small fires
against any cold we have had in Florida.
That is putting it pretty strong.

Prof. H. J. Webber: A scheme has been
mentioned to me, which seems to be a new
one. It may be old. In following the dis-
cussions in the California papers I have no-
ticed it has been mentioned. It is only ap-
licable on a limited scale, that is in con-
nection with irrigation plants. It seems
practicable, the experiment seems practi-
cable. The idea is, the steam from the irri-
gation plant be passed through the pipes all
about on the windward side of the grove.
A very small amount of steam will cover
the ground, and it can be kept up almost
definitely this way. It seems to me this
scheme wherever it is practicable to apply
it could be applied and made a success. It
has, I believe, been applied in frosts, and
also in freezes.

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CAMPHOR.

The Result of Experiments in the Cultivation of the Camphor Tree and the Manufacture of
Camphor Gum in Florida.

Verbal Report by H. G. Hubbard, of Crescent City, Putnam county, (Special agent of the U. S.
Department of Agriculture), submitted at the special request of the Society.

With Discussion.

[See Minutes Pages 1 to 6, Item 35.]

Mr. Hubbard: Mr. President and Gen-
tlemen of the Society; what I have to say
about Camphor production in Florida will
take me but a short time. I have been in-
terested in the subject of the production of
Camphor in the world at large for the past
five or six years.

About that length of time ago the late
Mr. A. J. Beach, the well-known nursery-
man of San Mateo, and his son Fred Beach,
had made a small quantity of camphor from
the leaves of camphor laurel grown on
their place. They boiled the leaves in a
common sugar kettle, covered with a
wooden cover and luted with clay. Through
the cover they screwed a length of one inch
iron pipe, and this pipe they kept cool with
water from a flowing well. The solid cam-
phor formed in the pipe, and soon choked it
up, so that from time to time they had to
remove the pipe and by ramming it on a board, they obtained a sample of camphor, which although somewhat mixed with impurities was pronounced the genuine article when submitted to the United States Department of Agriculture.

This result led me to seek for information on the subject of camphor production. Most of the published treatises are written in the Dutch language, and the information they give is not very modern and not very encouraging.

Quite recently, however, I learned some facts of importance, which quickened my interest in camphor and which seemed to me to present the subject of its production here in Florida, in a quite new and altogether more favorable light. In the present condition of our orange industries, it seems to me the horticulturists of Florida may well be interested in having another string to their bow, and I therefore present the following facts which I have gleaned concerning the production of camphor here and elsewhere.

Let me first say a few words in regard to the nature of camphor and its importance in the arts. Everybody knows of its important use as a medicine. This has, however, come to be but a drop in the bucket compared with its use in the arts. These uses are every day increasing. The most important perhaps at present is in the manufacture of celluloid, of which it is a necessary ingredient. Again in photography it is an indispensable article. No photographic dry plate can be manufactured without camphor. The peculiar, even unique properties of this gum in combination with other substances in the useful arts, seem to have been only just discovered. By its use the Japanese are beginning to reproduce in laquers and varnishes the properties of the long lost and now precious laquers of their ancient artisans. The camphor oil which is obtained with the gum and which formerly was wasted, and considered of no value, is now worth more than the solid gum, and has become an indispensable article to manufacturers of fine toilet soaps.

Smokeless powder was once manufactured with camphor as its most important ingredient, and were it not for the constantly diminishing supply of camphor, it is probable that its use for this purpose would never be superseded by any other substitute.

The camphor or campfire, of the earlier part of this century was a precious gum produced in small quantities by a tree growing wild in Sumatra and Borneo, the Dryobalanops camphorae. This camphor is still sold among the Chinese for more than its weight in gold. The Chinese will use no other than this particular variety. Not many years ago it was discovered that another tree also produced camphor. This tree, the Laurus camphora or as it is now called Cinamonum camphora from which the camphor of commerce is now made, grows native in China, Japan and other islands in the China seas.

Following this discovery, some thirty years ago, some of you may remember camphor suddenly dropped in price and for many years it was in common use as a material for keeping moths away from clothing as well as a very universal remedy in liniments, etc. It sank in price to about 15 cents per pound. Of late years, however, it has steadily risen in price and more recently the rise has been very rapid and at last became speculative. The world’s supply of this article which was every day becoming more and more necessary to civilized man, began to give out. Speculators at last made a corner in the crude drug and about a year
ago the price was artificially raised to 75 cents per pound. The death of Col. North in London, the chief speculator in this article, has quite recently released and thrown upon the market a temporarily large supply of camphor gum, and the price has fallen at once to about 39 cents. My best judgement is that the staple market value of the gum is at present not far from 45 cents per pound with a tendency to rise rapidly.

The world is looking anxiously for some new source of supply for camphor. In China its production, which used to be considerable has altogether ceased. In Japan only a limited amount of camphor forest remains. This is under government control and the output is very limited. The island of Formosa remains the principal source of supply. The interior of this island used to be one vast camphor forest. The trees there grow to very large size. They are said to reach a height of 150 feet. Of course in such trees the foliage is but a very small part of the whole tree, and is altogether inaccessible until the tree is cut down. As every part of the tree contains camphor and the roots and wood of the trunk contain most of all, the foliage of the tree was naturally neglected entirely in far away Formosa. Only the wood was used in the manufacture of camphor. In getting the camphor therefore the trees were destroyed root and branch.

The most wasteful methods are employed by the natives in these countries. In China the chipped up camphor wood is boiled with water in an iron kettle. The kettle is covered with a sort of conical straw hat. The camphor vapor condenses in the straw hat. In Formosa the camphor wood in the form of chips, is also boiled in an iron pot, but over this is placed an open pot of earthenware which has a perforated bottom and is also filled with straw. The camphor sublimes in this straw. In Japan they had a rather better method, an improvement on that of Formosa. They boiled the chips of camphor wood and roots in an iron pot from which a bamboo tube led into a condensing box, cooled with running water. In all these methods they only got a percentage of the camphor. How much was lost no one knows. The valuable camphor oil was all lost of course. The camphor which they obtained was mixed with straw and dirt. It was packed in boxes lined with lead, like tea and was formerly all or nearly all sent to Amsterdam to be refined. When received it was black and dirty like the West Indian muscavedo sugar, and mixed of course with fragments of straw.

The Amsterdam process of refining was to put some of this impure camphor into a carboy, that is a sort of jug made of glass, in which acids are transported. The carboy was placed on a sand bath over a furnace and gradually heated until the camphor melted and then boiled. In continued boiling the camphor is all vaporized and sublimes in a solid cake in the top of the carboy, while all the dirt is left at the bottom. Long needles are used to keep open the passage for vapor in the neck of the carboy. This method is still in use at Amsterdam, or was a short time ago. In recent years considerable rough camphor has been refined by American chemists at Philadelphia. They use a cast iron dish, very much like an old fashioned Florida baking kettle. This is covered with another shallow dish or pan of sheet iron, about three inches deep inverted over the first, like a cover. In the top of the cover is a round hole an inch in diameter and over this is placed loosely a small cone of sheet iron. The rough camphor is placed in these iron dishes, a row of
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20 to 50 of which are placed in a long sand trough over a furnace. They are heated gradually until the camphor boils and the process is then continued at the same temperature until all the camphor has formed in a cake in the cover, leaving the impurities below. The holes must be constantly watched, the cones lifted from time to time, and the vents kept open with a sharp wire.

All these processes were known to me some years ago, but still I hesitated to plant camphor, believing that sooner or later the island of Formosa would fall into the hands of the Japanese, who are famous traders like the Dutch, and who would be sure to turn out camphor more cheaply than we could hope to make it in this country.

Last fall, however, in Washington, I met a gentleman who is much interested in economic questions and especially in the production of camphor. He is, in fact a specialist, attached to the German legation in Washington, engaged in the study of economic questions of this sort. This gentleman, Baron B. R. von Herman, had heard that I was interested in horticulture in Florida, and he asked if the camphor tree would grow in Florida. He stated that the industrial world was anxiously looking for some new source of supply as the old was very nearly exhausted. I answered yes, that in quite an extended experience with introduced plants in Florida, I knew of no tree that would grow better than the camphor. But said I, what about Formosa, can we compete with that island? Baron Herman replied that the camphor forests of Formosa had been nearly all destroyed. He said, “I have only recently returned from Formosa, where I have been investigating the camphor industry. I had interviews with many Europeans who had been super-

intending the native trade in the far interior. They had returned to the sea coast for lack of business, and reported that in two years, no more camphor will be produced in Formosa.”

This very unexpected information greatly revived my interest in camphor. I naturally wished to find out what percentage of the gum our Florida trees contain. After some rather rude, but still I believe quite accurate experiments I am able to state that the leaves and twigs of young camphor trees in Florida contain one pound of the solid refined gum to every seventy-seven pounds of fresh leaves. This is a much greater percentage than has been obtained in India or than has been obtained from leaves imported from Japan. It is the best showing that has been made in any country so far as I can learn.

To obtain this camphor it is not necessary to destroy or even to injure the trees as has been recklessly done elsewhere. A camphor tree will stand pruning back to almost any extent. It makes three growths per year with us. One in April, one in June and a scattering growth in late summer.

The method pursued by my partner, Mr. Goldsmith Williams and myself in our preliminary experiments was a very simple one. We had the covers of two empty lard cans, holding five gallons each, soldered together with a short tin pipe of about 1½ inches diameter. One of these we used as a boiler and the other as a condenser. The boiler was filled with twigs and leaves fresh cut from the trees, enough water added to nearly fill the can and the water was brought to brisk boiling and kept there for half an hour. The other can was kept cool by pouring a stream of water over it. The camphor all sublimed on the underside of
the cover of the condenser in the shape of
snow white flakes, absolutely free from im-
purities of any sort, except that it was wet
with condensed steam. The distilled water
which collects in the bottom of the con-
densing can contains some camphor and
also the camphor oil, which can be saved by
redistillation.

This is a rather slow method of obtaining
the camphor. It is, however, a cheap and
easy process and can be followed by any
one. On a large scale a better method un-
doubtedly would be to use dry steam. An
ordinary steam boiler supplying steam at
90 pounds pressure would give a tempera-
ture of 300 degrees. This would drive the
camphor from the leaves very quickly and
economically. The apparatus required
would be a steam boiler of any ordinary
sort, connected with a second boiler in
which the leaves are enclosed, and connect-
ed with this in series, a condensing vat of
wood or metal which can be cooled with
running water. The condenser might re-
main unopened and receive repeated
charges until nearly or quite filled with
camphor.

Camphor leaves if submitted to the action
of steam at a temperature of 300 degrees,
i.e., at 90 pounds pressure would not re-
tain a trace of the gum after five minutes'
treatment. The camphor obtained in this
way would be pure as snow. The camphor
oil and water which it contained could be
removed by pressure in a hydraulic press of
very simple construction.

The cultivation of camphor offers some
very unusual agricultural advantages. First
and foremost is the important fact that it
removes absolutely nothing from the soil.
The gum is entirely a product of the gases
in the atmosphere. If the leaves, after the
gum is removed, are returned to the land,
nothing is lost. On the contrary there is
a constant gain and as in the forest the soil
will grow richer year after year. An old
camphor plantation therefore, after it has
covered the ground will need no fertilizing
whatever. The only advantage in fertiliz-
ing will be to hasten growth in the young
trees.

Another very great advantage is that in
Florida the crop can be harvested almost at
any time. Except when the plants are in
young growth, one season is probably as
good as another.

Again, young camphor trees may be
made to produce at two and three years
from the time they are set. The tree is the
densest grower of any I know. There is al-
ways considerable inside growth which can
be removed not only without detriment, but
even with profit to the young tree. This
inside growth contains as much or more
camphor than the outside growth. In a tree
that has been planted three years the inside
cuttings will amount to 60 or 80 pounds in
the course of the fourth season. At the
same time two cuttings of 100 to 150
pounds of leaves each can be obtained from
the outside growth of the same tree at that
age. In other words they will produce four
or five pounds of gum. The trees standing
10 to 12 feet high at the beginning of
spring, should not be reduced in size by
the cutting.

The camphor tree is quite as hardy as the
swamp gums or maples with us. It was
hurt by the second freeze of February, 1895,
somewhat, and about half the foliage was
cut at that time. Some trees were cut to
the ground and some were not hurt at all.
One need never lose a crop, however, for
camphor can as well be made from the
frozen leaves, and I don't believe the tree
can be killed by frost in our climate. It is
not likely, however, that any of us will ever
see the leaves frosted again.
In regard to proper methods of cultivation it is impossible to give more than suggestions. For quick returns, perhaps the hedge system will prove best, that is to say trees three or four feet apart in hedge rows 15 feet apart. For ordinary planting, I would suggest plants 15 feet apart in rows 20 feet apart; the intention being to keep the trees cut back to the size of eight or 10 years. Planted in this method I think a plantation in its fourth season should return $300 to $400 per acre, with camphor gum at 40 cents. The fifth season ought to at least double this return.

I have here about 1½ ounces of camphor which we obtained from seven pounds of leaves. It is just as it came from the condenser. You will notice that it is white and pure as snow. It contains no impurities. In this vial I have some of the distilled water which contains some camphor and also camphor oil. This is also taken from the condenser, and is a valuable household liniment and medicine just as it is. The third vial which I will pass around contains the solid camphor gum sublimed from the snow-like wet camphor obtained from the leaves.

**DISCUSSION.**

(The discussion given below followed Mr. Hubbard's report).

**Question.** What character of soil is best to produce the camphor tree in Florida?

Mr. Hubbard: We got our best results, from heavy clay soil in Volusia county where we had five year old trees. We got about 900 grains from seven pounds of leaves, from these trees. The camphor tree grows best, however, on our best pine land soil. It responds very quickly to cultivation, but if care is taken will grow on rather poor soil. I have seen camphor trees growing on our scrub lands, but I will not recommend growing camphor trees on sterile soils.

**Question.** What would you think of low hammock land, moist?

Mr. Hubbard: Camphor will grow admirably on low, wet lands, whether it will grow in water I do not know. It would grow perhaps on overflowed hammocks if the sun light is not let in to destroy the roots.

**Question.** What would be the proper distance apart to plant them, how many per acre?

Mr. Hubbard: Fifteen feet apart; unless hedge culture is adopted; the trees should be 15 feet apart and 20 feet between the rows.

**Question.** What is the proper way to propagate, from the cuttings?

It can be done from cuttings only if you have bottom heat, it is easily produced from the fresh seed. The seed sells for $2.50 per pound, and is about the size of allspice. Thorburn & Co., Seedmen, New York, sell it. If dry the seed germinates very slowly.

Geo. H. Wright: I understood you to say that you would not try to use the wood or bark.

Mr. Hubbard: I use leaves and twigs at present. If I had old plantations I might use the wood also.

Mr. Wright: Why would you not use the roots?

Mr. Hubbard: I do not know but possibly it might be found the best way to plant in sections, and after the trees reach the size you determine on, to cut them off, one section each year and use everything. It might not be best to destroy the roots however.

A member: By cutting the camphor tree
in January it will reproduce itself. That is the old process of making camphor as laid down. I have tried the cutting off process in Florida, and I know they will reproduce themselves.

Mr. Hubbard: If you pursue that system you will increase my estimates materially. I have figured on clipping only the surplus leaves.

O. P. Rooks: I have been interested in the subject. I have been looking into the question myself for some years. I have camphor trees 14 years old, 20 feet high. I have thought of planting camphor trees on my place for fences, hoping to utilize the leaves in a commercial way. I was talking with a wholesale druggist in Ocala, and he assured me last week he paid 50 cents a pound for camphor gum, now he is paying 75 cents a pound. I have utilized the leaves of camphor in my poultry business by putting a few handfuls of leaves with the setting hen. I have quite a number of trees that will seed this year, and intend to plant the seed and raise as many plants as I can.

Lyman Phelps: How large camphor trees have you seen in Florida?

Mr. Hubbard: About the height Mr. Rooks states; I had them 20, 22 and 25 feet, the trees that were first sent out by the United States Department of Agriculture, were the largest I had.

Mr. Phelps: There were some trees growing under my care, which stand 70 feet high, and the trunks of some of them are 15 inches in diameter; they were on good pine lands, and had the same care as orange trees had. I have made experiments in distilling the leaves and got nearly one per cent, but at the price I did not think it would pay then.

ORANGES AND CITRUS FRUITS.

Sprouts From the Frozen-Back Trees—How Many Should be Allowed to Grow, and how Should These be Treated?—The Single vs. the Divided Stem.—Best Varieties to Bud.—The Origination of new Varieties.—Influence of Environment on the Characteristics of the Fruit.

"Ad Interim" Remarks by Lyman Phelps, of Sanford, Orange county, with Discussion following.

[SEE MINUTES PAGES 1 TO 6, ITEM 30.]

L. Montgomery: I want to know what to do with our sprouts? How many to leave, how close to the stump to leave them, whether it is best to leave them all and what is the best time to prune out?

Lyman Phelps: As for experience it must be very limited. We have had no such freeze in two decades as we had last winter. In '76 or '75 we did have some trees four inches in diameter cut nearly to the ground by cold. I tried to save the sprouts on many of those and nursed them along for a number of years; but they were not worth in five years as much as those from the stumps cut close to the ground and three to four shoots budded; and those three or four