mollis, the downy hawthorn, along with *C. arnoldiana*, the Arnold hawthorn, in our recommendations, as suitable hardy *Crataegus* rootstocks.

All of the material from this experiment will be replanted in the spring of 1965 and the remainder of this story will unfold with the passing years.

MODERATOR SHUGERT: Thank you very much, Mr. Cumming. Next speaker on our program will be speaking about nursery propagation of Carpathian Walnuts, Ben Davis II, Ozark Nurseries, Tahlequah, Oklahoma.

NURSERY PROPAGATION OF CARPATHIAN WALNUTS

BEN DAVIS II
Ozark Nurseries Company
Tahlequah, Oklahoma

The first step in nursery propagation of Carpathian Walnuts is, thorough and adequate soil preparation. The site chosen for planting may have swags or low places that will need leveling. Either a dozer blade or a large float may be used to fill in the swags so that water will not stand in the field. After the site is properly leveled, it must be broken. At Ozark Nurseries we use a large offset disc, which cuts 9½ feet wide and 10 to 12 inches deep. The disc has the advantage of chopping up any trash present, while breaking the ground. After the ground has been broken, and the trash worked into the soil, some type of subsoiling should be done. This allows the ground to store up water during heavy rains and give it back to the plants during dry weather. The loosened soil also encourages better growth and makes digging operations easier when the trees are ready for sale. For nut trees, we use a large ripper which breaks up the soil to a depth of 36 inches. After this is done, it is necessary to run the offset disc again to level the soil and fill in the furrows left by the ripper. Then a disc harrow, with a spike toothed harrow pulled behind, is used to break up any clods and smooth and level the soil for planting.

Planting operations are begun in the fall by marking off rows 4½ feet apart with a V-shaped shoe that leaves a smooth furrows 2 to 3 inches deep. This shoe is mounted on a one-row tractor and is followed by a planting crew which drops the nuts, by hand, 5 to 6 inches apart. The nuts that we use are Native Black Walnut, or *Juglans nigra*. Immediately behind the crew dropping the nuts follows a one-row tractor with disc hillers. The disc hillers pull the soil in over the rows to cover the nuts. This keeps them moist until spring and prevents them from being heaved out of the ground during freezing and thawing. Once the nuts are covered they are left undisturbed throughout the winter.

The following spring, as soon as the weather warms up, the nuts are checked periodically by digging down into the hills to

see if they have started to germinate. As soon as root sprouts are evident coming out of most of the nuts, a spike-toothed harrow is dragged over the rows. This pulls down the dirt that was hilled up over the nuts the previous fall. After this operation is completed, the nuts will be 2 to 3 inches below the surface of the soil.

If there is an exceptionally good stand of seedlings, it will be necessary to thin them as soon as all the seeds have germinated and the sprouts are evident. We think that thinning out to a distance of 10 to 12 inches is best. This will allow them to reach proper size for budding the same season.

The seedlings are fertilized several times during the season. The first application is made as soon as the seedlings are big enough to be seen. The fertilizer is put on at the same time the seedlings are cultivated, with a fertilizer side dressing attachment. As the seedlings grow larger, the fertilizer is put on in larger doses, each application consisting of about 50 pounds of 15-10-10 analysis commercial fertilizer per row. The rows are approximately 650 feet in length.

During the time the seeds are germinating and the seedlings are being fertilized, an intensive irrigation program is carried out, unless of course there is adequate rainfall. The idea of the intense fertilization and irrigation is to grow the seedlings as large as possible before budding time in August. Irrigation is carried on all summer to keep the seedlings in an active stage of growth so the buds will heal on satisfactorily. If the seedlings are allowed to stop growing, the buds will not live, even though the sap may be good enough for budding. The seedlings *must* be in a highly vigorous state of growth until after the bud has completely healed on. We have learned this the hard way in our experiences with budding Pecans. However, we have found that budding Carpathian Walnuts has not been as difficult as budding Pecan.

The method of budding used is the Forkert Method, which is explained and illustrated in the *Grafter's Handbook*, by R. J. Garner. The only difference is that we wrap the buds with poly vinyl tape rather than waxed cloth as mentioned in the book. Use of this method of propagation for nut trees was discussed previously by the writer at the 1962 meeting. Some of the material presented here duplicates the previous paper.

We have been fairly successful using this method of budding on Carpathian Walnuts. The take has never been less than 70% and as high as 100%. This sounds very good, but before anyone gets too excited, I would like to point out that we have not been able to get the buds to force out in the spring as they should. The seedling tops are cut off about $\frac{3}{8}$ inch above the bud eye just before the understocks start to leaf out in the spring. Periodically, all the seedling suckers are pulled off the understocks leaving only the bud sprouts, if any. However, it seems no matter how many times we pull the suckers off the

understocks, about 70 to 80% of the live buds refuse to force out.

This year, we began Walnut budding on August 14th. We tried a total of 15 experiments with late summer bud forcing to try to overcome the spring bud dormancy on Carpathian Walnuts. We tried crippling the understock by breaking it over 3 to 6 inches above the bud at several different intervals after the budding was done. The best results were obtained by breaking over the understocks 9 days after budding. In this experiment, 25 understocks were broken and 25 were left unbroken for comparison. On both the broken and the unbroken understocks, we obtained 100% bud take. On the broken understocks 72% of the buds sprouted, and on the unbroken understocks only 4% of the buds sprouted. We are reserving judgment on these results until we find out how well the sprouts survive the winter.

In another series of experiments, we tried solutions of Giberellic Acid, Napthaleneacetic Acid, and Indolebutyric Acid. These solutions were painted on the buds 10, 14 and 21 days after the budding was done. In all of the experiments in this series, the bud take was not affected and seemed to be no better nor worse than the buds left untreated for comparison. There was no sprouting as a result of the application of these materials. In another test, the bud shields were completely immersed in a solution of Gibrellic Acid before the buds were set in place. This solution was mixed as follows: 2 tablespoons full of a 500 parts per million solution, per ½ measuring cup of water. In this experiment, 96% of the buds turned black and died and did not at anytime start to unite with the understock. Four percent lived but looked very sickly. On the buds left untreated for comparison, there was a 100% bud take, but none of the buds sprouted.

It would take too much time to go into the details of all the different experiments we tried, and the ones we hope to try next spring. However, it is hoped that we will able to give a complete report on all the tests we tried and the results obtained, at a later date.

Our overall results for the 17,117 *Juglans nigra* understocks which were budded last August were as follows:

Black Walnut Varieties: a total of 5,739 buds were done and 5,102 buds lived for a live bud percentage of 88.9%.

Carpathian Walnut Varieties: a total of 11,378 buds were done and 8,712 buds lived for a live bud percentage of 76.6%.

If we can work out a system of successfully forcing the Carpathian buds, we will have solved our main problem in producing these trees.

To us another major problem in the propagation of Carpa thian Walnuts is that of obtaining an adequate supply of budwood. To achieve this purpose we have established several small test orchards which consist mainly of varieties we obtained from Royal Oakes at Bluffs, Illinois. Most of our trees

were first planted in 1956 but many had to be replanted in later years. We do have several trees that survived the first planting in 1956 and they are now getting large enough to furnish us quite a lot of budwood.

In the slide presentation which follows, you will see some of the work we have been doing in trying to establish our own source of budwood, both for Carpathian and Black Walnuts.

Polyvinyl Tape Used To Wrap Walnut Buds

½ inch by 300 foot rolls
All Purpose Grade
Manufactured by: L. E. Cooke Company
5716 North Vista Street
San Gabriel, California

Gibrel Growth Promoting Substance

Manufactured by: Merck Chemical Division
Merck & Co., Incorporated
Rahway, New Jersey

Handled only through distributors. Write them for distributor nearest you.

Napthaleneacetic Acid

Manufactured by: Millmaster Chemical Corporation
99 Park Avenue
New York 16, New York

The Grafters Handbook, by R. J. Garner

Oxford University Press
New York, New York

GibTabs

Manufactured by: Eli Lily & Company
Greenfield Laboratories
Box 708
Greenfield, Indiana
Dr. Edwin F. Alder, Head
Plant Science Research

MODERATOR SHUGERT: If you have any questions for the three speakers of the first quarter, please write them on a slip of paper and place them in the question box. Kicking off the second quarter, a paper "Isolation of a Dampening-Off Inhibitor from Sphagnum Moss' prepared by Gayle Fleming and Dr. C. E. Hess. It is with a great deal of pleasure that I introuce Dr. C. E. Hess who is going to present the paper to you at this time.