low order that it would be feasible to use fluorescent light for propagation on a commercial scale.

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MODERATOR CANNON: Our next paper is by Dr. John McGuire. Dr. McGuire is at the University of Rhode Island and will speak on the entrance of growth regulators into cuttings.

ENTRANCE OF SYNTHETIC GROWTH REGULATOR IAA-2-14C INTO CUTTINGS OF ILEX CRENATA 'CONVEXA'

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Since the late 1930's when synthetic growth regulators were found to be effective in promoting rooting of cuttings, a wide variety of methods have been used to introduce these materials into stem tissues. We are all familiar with talc preparations used as a dust, and aqueous solutions used either as long term dilute soaks or short duration concentrated dips. The relative efficiency of these carriers and methods was covered extensively at a meeting of this society in 1959 (5,6,9). It was concluded that concentrated basal dips were superior to other methods of application.

It has been shown that crystalline indoleacetic acid (IAA) can enter the fatty portion of the cuticle of leaves without the aid of a solvent. Crystals have been applied to stems after the stem was scraped to facilitate rapid uptake of the auxin (3,4). Auxin has been soaked into wooden pegs and the pegs have been inserted into holes drilled into the cuttings (10). In England and America, cuttings have been exposed to vacuum and then aqueous solutions of auxins have been forced into the stem when atmospheric pressure was again applied (1,11).

Contribution #1262 of the Rhode Island Agricultural Experiment Station

Auxins have been applied to foliar portions of cuttings under normal atmospheric pressure, but in the early work results were not generally successful (2,7). More recent work at the Rhode Island Agricultural Experiment Station has shown that this method can be used successfully. This work was reported to this society last year (8).

It has been determinated by detection of radioactive auxins in cuttings that sufficient auxin for increased rooting can be absorbed through the intact foliage and terminal bud of cuttings of *Ilex crenata 'Convexa'*. A method has been devised by which the radioactive isotope is extracted with high speed centrifugation and measured by means of liquid scintillation counting. By making extractions and counts at timed intervals from segments of cuttings at known distances from the site of application, it is possible to determine how long it takes for the auxin to enter the cutting and how rapidly it moves within the cuttings.

When IAA-2-C14 was applied to five inch long cuttings of Ilex as a ten second basal dip in 40% ethanol (v/v), it was found that the isotope was carried to the uppermost inch within 24 hours. The largest portion remained in the lowest inch with progressively lesser amounts in each succeeding inch up the cutting. The least amount was found in the terminal inch. When the radio-chemical was applied as a ten second terminal dip, the largest amount of activity remained in the inch that was dip-

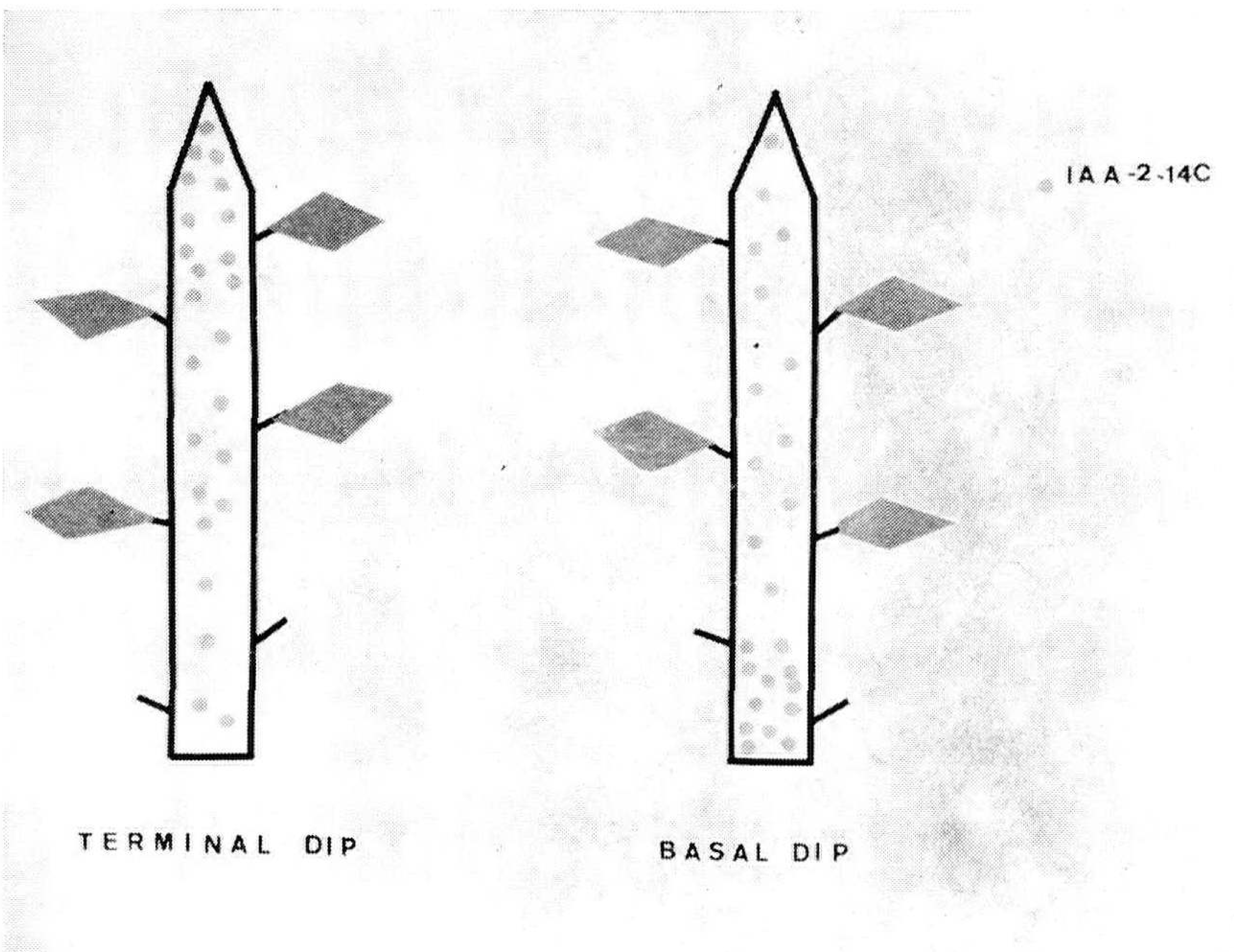

Figure 1. Comparison of auxin uptake and distribution in terminal and basal applications of IAA-2-C14 in cuttings of *Ilex crenata* 'Convexa'.

ped, and each lower inch contained progressively less activity with the exception of the lowest inch, which contained slightly more activity than the fourth segment from the tip (Figure 1).

The effect of leaf surface area on transport of IAA was studied by dipping terminal cuttings, which had the upper leaves removed, in IAA-2-C14 and comparing levels of C14 in stem segments with similar segments from cuttings that were similiarily treated but from which leaves had been removed. More of the labeled isotope was incorporated into the partially defoliated cuttings but less was transported to the basal area where rooting takes place. (Figure 2) More inhibition of terminal and lateral buds took place in the defoliated cuttings.

Since it is known that auxin moves with carbohydrates, it is not surprising that cuttings with less leaf surface do not exhibit the same degree of basipetal or downward movement of C14 as fully foliated cuttings. It was suspected that increased auxin uptake in cuttings with defoliated terminals may have occurred through freshly exposed leaf scars on the terminal inch. It was therefore postulated that the same thing could occur through leaf scars on the basal inch of stem cuttings which are normally defoliated as a commercial practice prior to treatment with auxins. The following experiment was designed to answer this question.

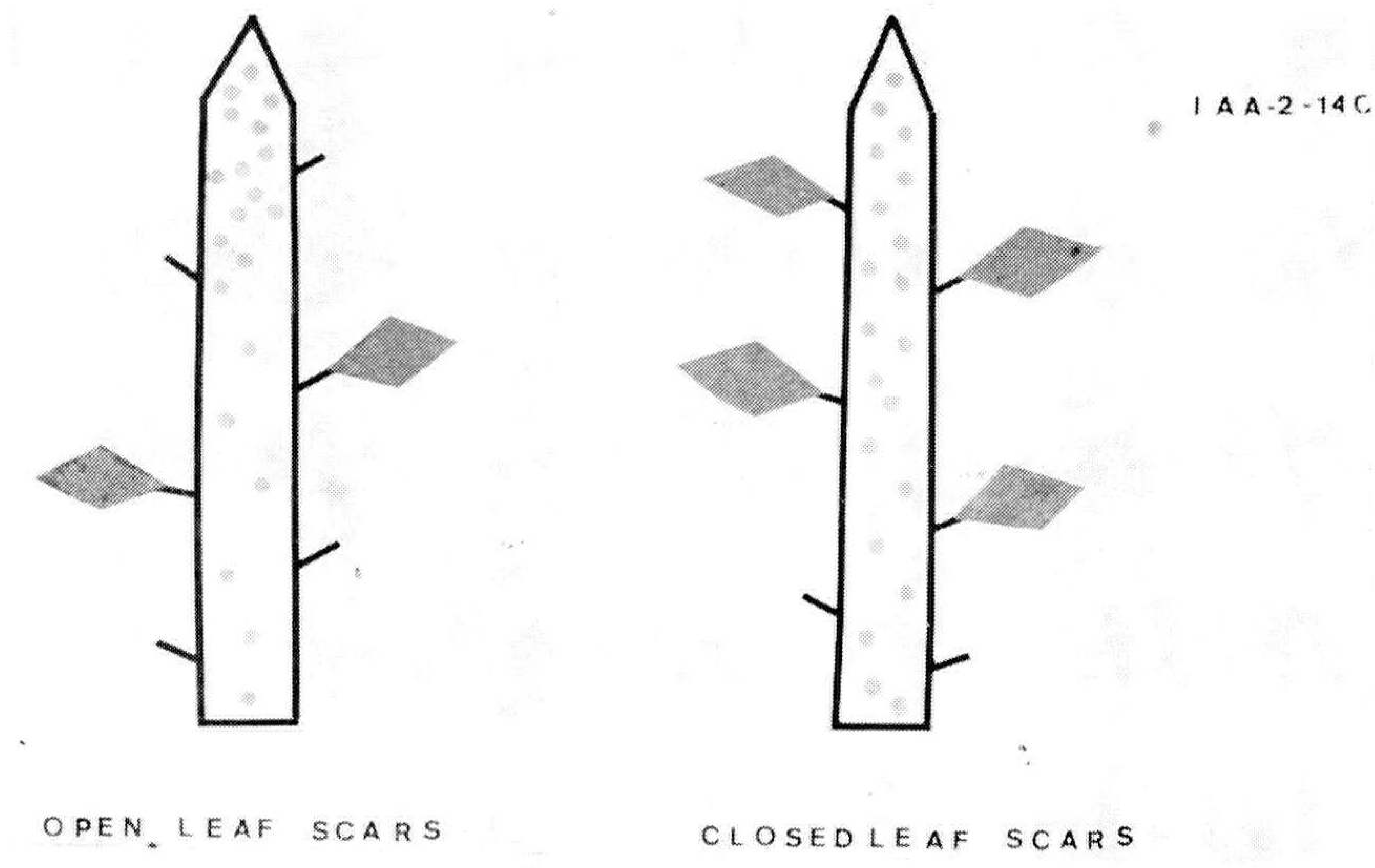

Figure 2. Effect of leaf surface area and leaf scars on auxin uptake and distribution of IAA-2-C14 in cuttings of *Ilex crenata* 'Convexa'.

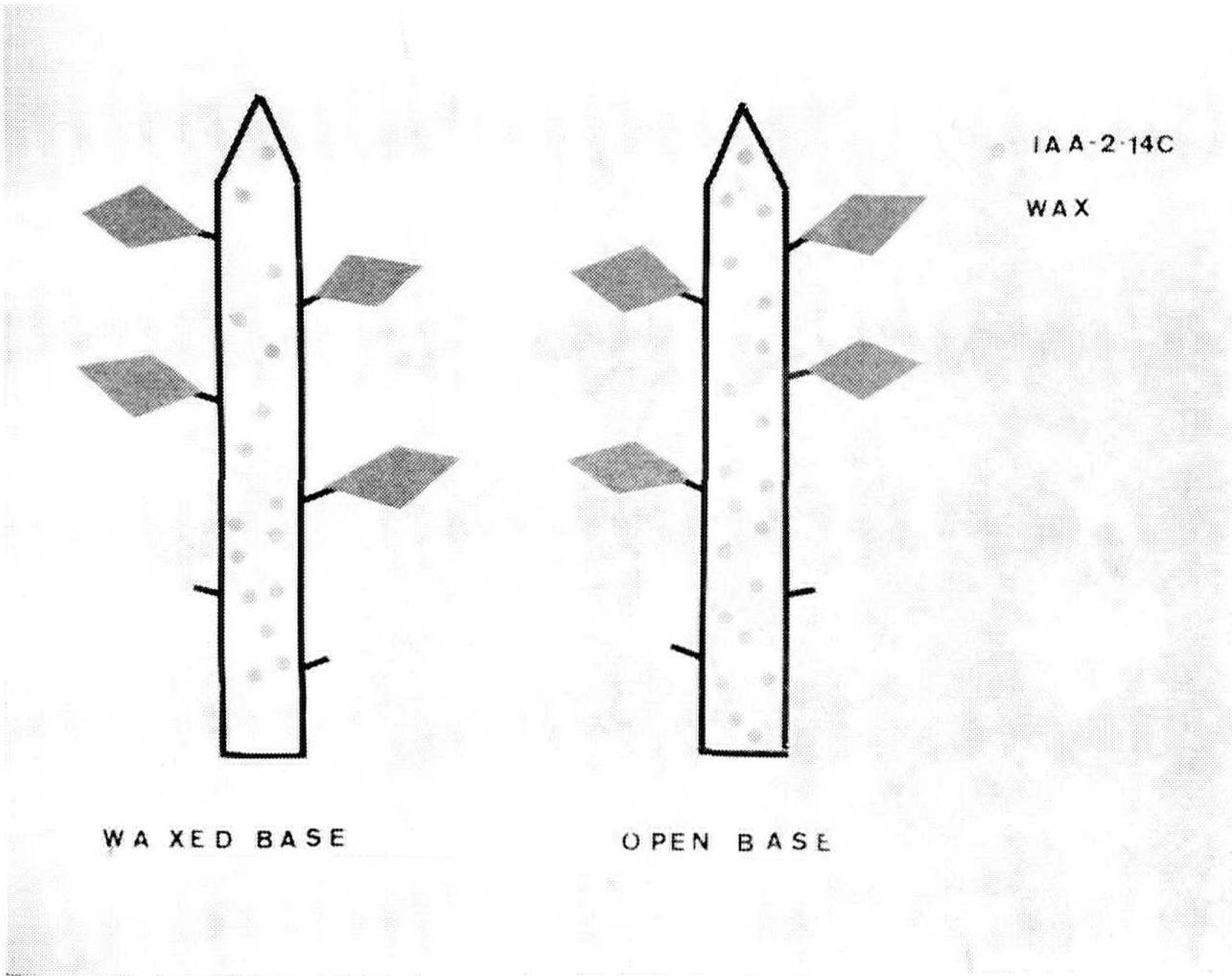

Figure 3. Effect of leaf scars on auxin uptake in basally dipped cuttings of *Ilex crenata* 'Convexa'.

Cuttings were dipped basally into the radioactive auxin (IAA-2-C14) and then they were extracted as previously described. These cuttings were compared to others which had the basal ends sealed with paraffin at the time of basal dipping so that only the outer surface of the stem and the leaf scars were exposed to the radiochemical. The study of the segments revealed that less auxin entered the cuttings with sealed ends. Cuttings with the basal end covered with wax absorbed approximately 60% as much radioactive auxin as cuttings with the basal end not waxed (Figure 3).

When rooting data were compared, it was found that there was no significant reduction in rooting when basal ends were sealed. If cuttings were dipped basally after the basal end and leaf scars were sealed with paraffin, no IAA-2-C14 entered the cuttings. It was also found that wounding the basal inch of a cutting prior to dipping in the auxin solution did not result in a significant increase in auxin uptake. If the wound was present and the cut ends and leaf scars were sealed, an amount of auxin equal to that which would have been absorbed through the ends and leaf scars was absorbed.

Terminally treated cuttings were found to be unaffected in regard to transport of IAA-2-C14 by the presence of the apical bud (Figure 4), if the apical bud was removed before the terminal end of the cutting was dipped in the auxin solution, greater quantity of auxin was absorbed. This increased uptake did not result in greater quantities being carried to the basal areas.

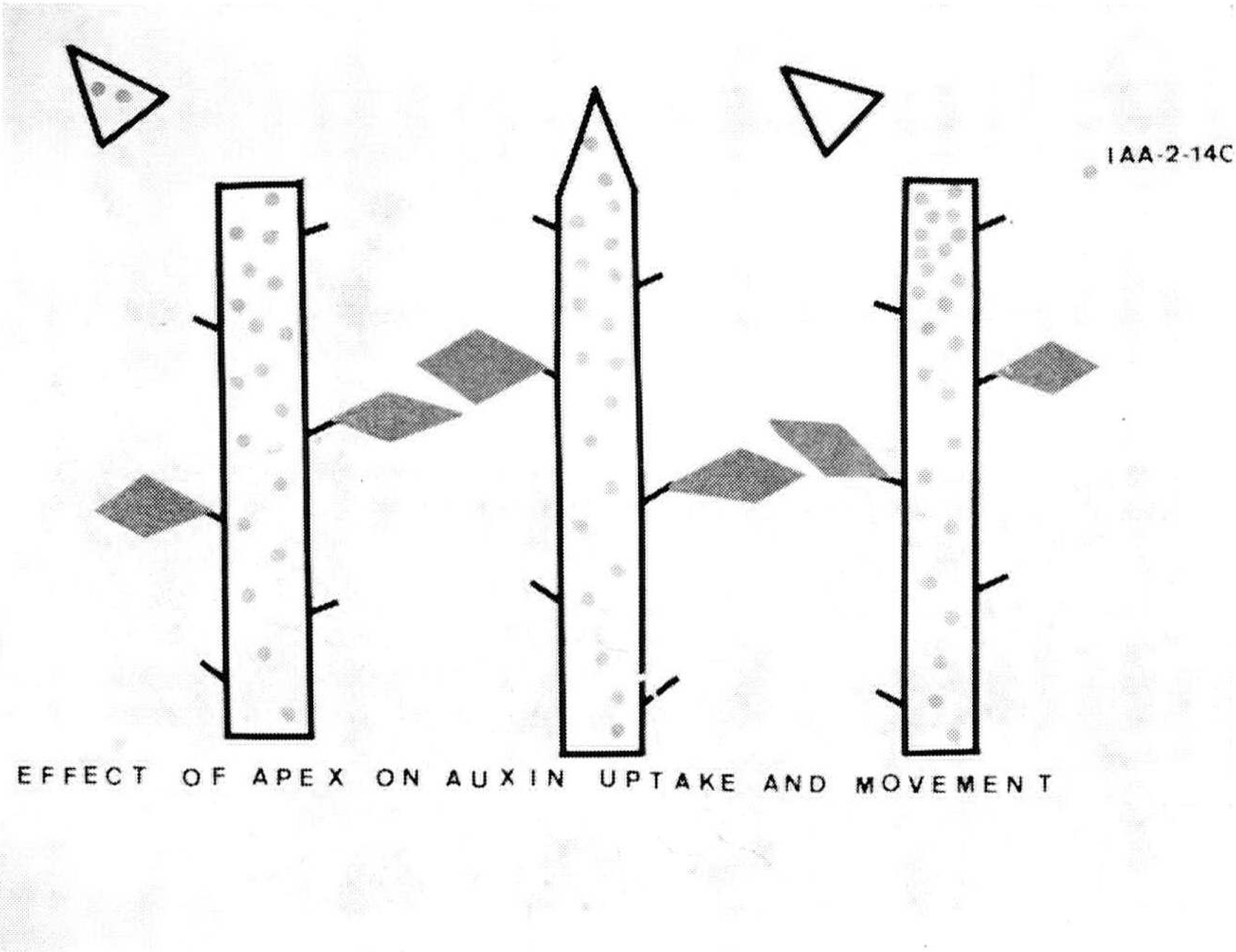

Figure 4. Effect of apex on auxin uptake and movement in cuttings of *Ilex crenata* 'Convexa'.

SUMMARY

It has been found that sufficient auxin enters the foliage and terminal bud of cuttings of *Ilex crenata 'Convexa'* to result in effective increases in rooting. When basal ends of cuttings were dipped in solutions of IAA-2-C14, more auxin is absorbed than in terminal dips. The basally applied material is carried to the apex within 24 hours. When leaves are removed from the upper end of cuttings, more radioactive auxin is absorbed by the cuttings. When leaves are absent from the terminal areas of terminally treated cuttings, however, less auxin is carried to the base of the cutting. It is probable that auxin enters through the leaf scars. Wounding the basal area of a cutting did not materially increase the amount of auxin absorbed, but if the wound was the only available port of entry, auxin did enter the cutting in that way. Removal of apex did result in increased auxin uptake of terminally dipped cuttings, but it did not result in increased transport.

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MODERATOR CANNON: We now have time for some questions.

VOICE: I would like to ask Dr. Waxman if he feels it is necessary to regulate the night and day temperatures within his structure?

SID WAXMAN: If you are referring to a fluctuating temperature between night and day, I do not think that this is necessary. When germinating seeds, this is often very beneficial but with the rooting of cuttings, I think a constant temperature will be satisfactory.

BEN DAVIS: I would like to ask Dr. Lanphear about the Simazine and Diphenamid combination? You put that on at the rate of one pound Simazine and four pounds Diphenamid. Did you reduce the amount of Diphenamid used because of the presence of the Simazine?

FRED LANPHEAR: The Diphenamid was included because of its ability to control grasses and it does this very effectively at four pounds. The main reason for reducing the amount that is used is to reduce the cost.

BEN DAVIS: I was wondering because I have been using Enide (Diphenamid) and the recommendation was to use it at the rate of six pounds per acre.

FRED LANPHEAR: If you use the Diphenamid by itself, it is necessary to use it at the six pound rate.

BEN DAVIS: Do you believe you would obtain injury if you used the six pound Diphenamid rate in combination with the one pound rate of Simazine?

FRED LANPHEAR: No. you would not have any injury; it would just be more costly.