THE SEASONAL RESPONSE IN ROOTING OF EVERGREEN CUTTINGS

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It is common knowledge among propagators that cuttings from most species root better at certain times of the year than at others. With narrow-leaved evergreens, we usually think of fall and winter as being optimum. The effectiveness of root-promoting substances such as indolebutyric acid (IBA) also depends on the season the cuttings are taken. However, very little is known about the controlling mechanism in this seasonal rooting response. Our first consideration might be the environmental differences that exist between seasons. One environmental factor that is particularly interesting in conjunction with this seasonal rooting response is photoperiod or the daylength. There have been numerous reports on the effect of photoperiod on rooting, mostly demonstrating the promotion of rooting by extending the photoperiod (3, 4). However, this is not always true. In some earlier work (2) we found that long photoperiods actually reduced the rooting of cuttings of Japanese yew and certain junipers taken in February. We therefore became interested in determining the role of photoperiod in controlling the seasonal rooting response, and in determining to what extent this response could be modified, either by manipulating the photoperiod or by treating with IBA. In addition, since this environmental control must eventually exert its influence on some

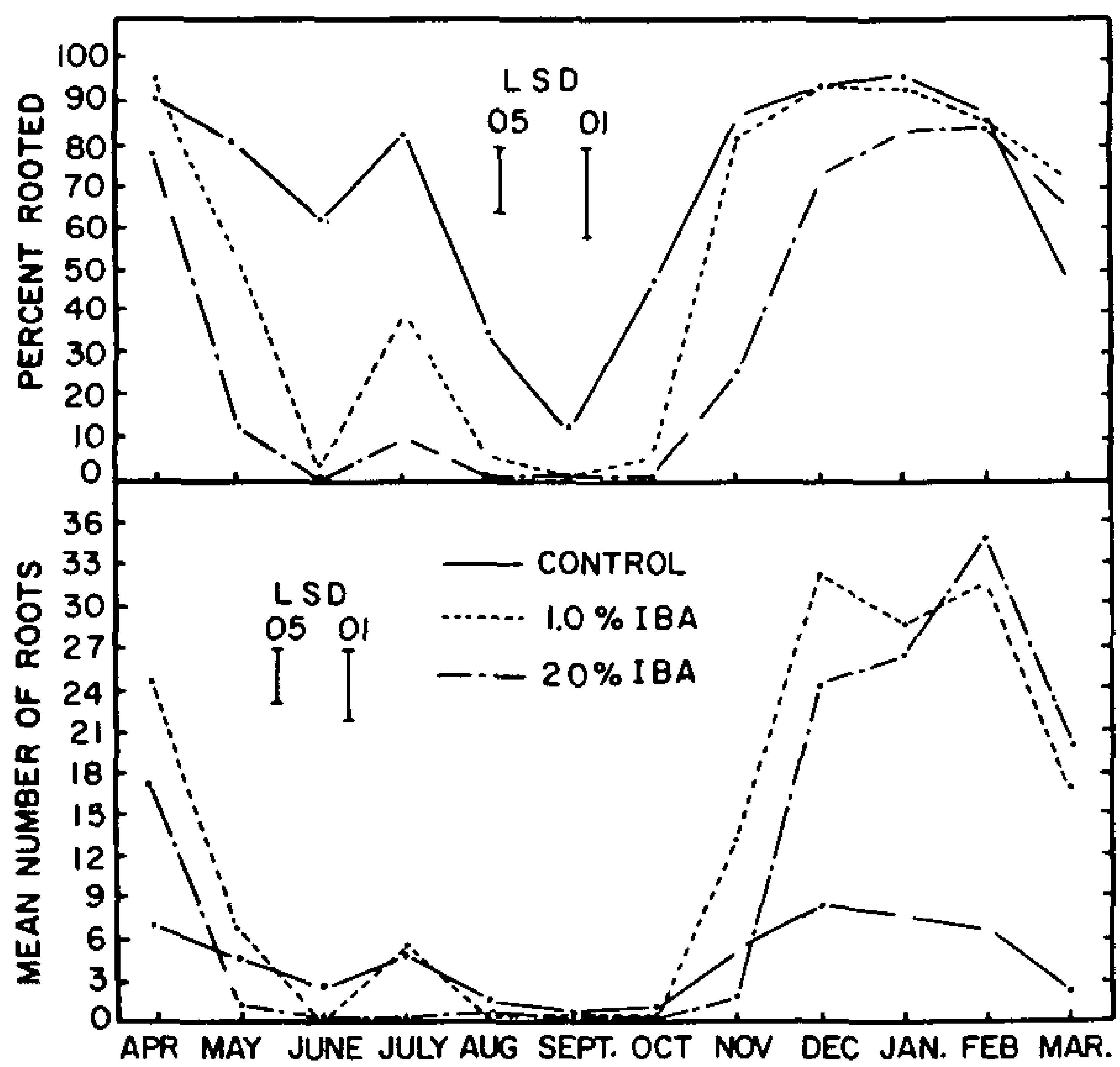

Fig 1. The effect of IBA on rooting of Andorra juniper cuttings taken at monthly intervals

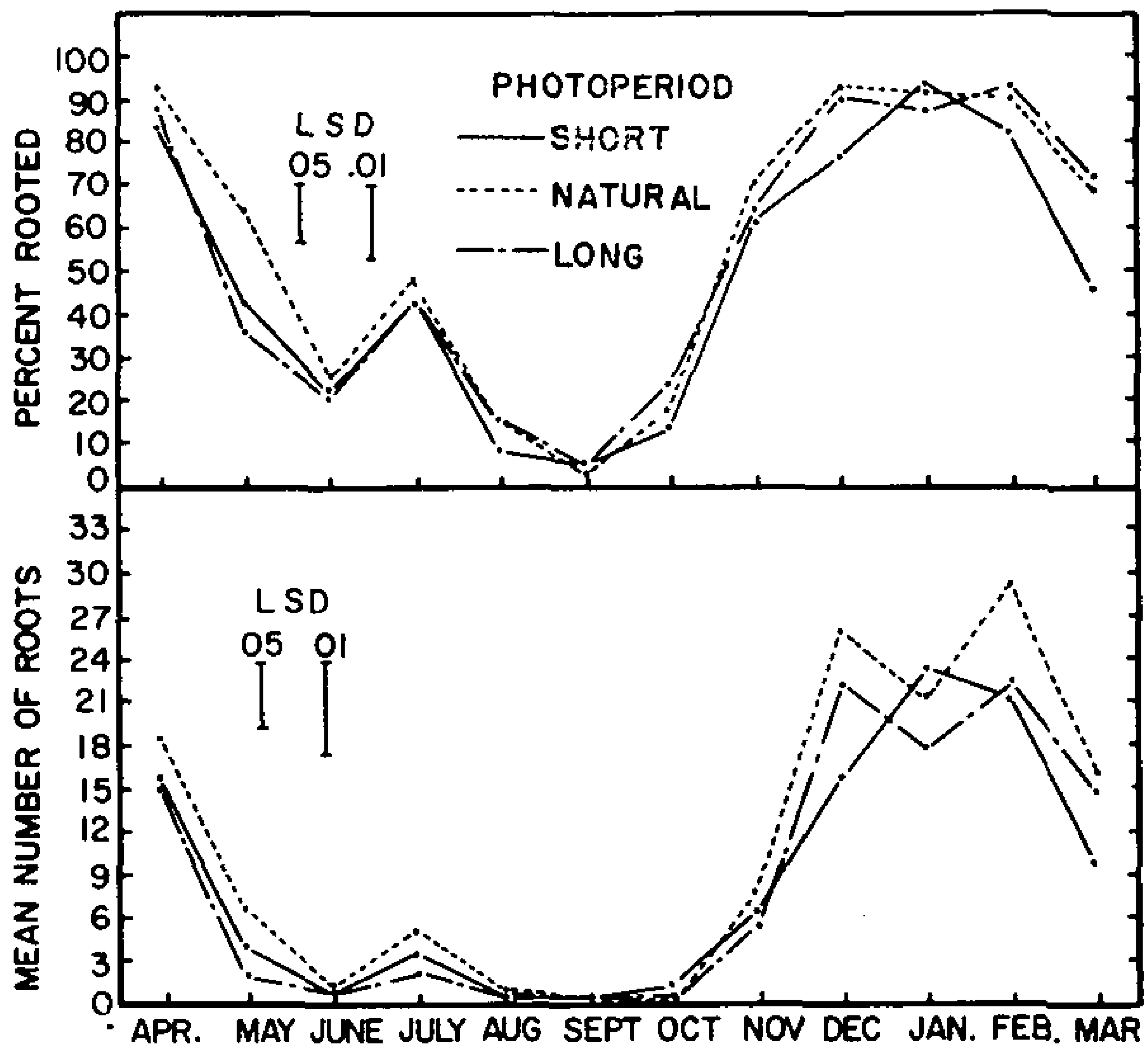

Fig 2. The effect of photoperiod on the rooting of Andorra juniper cuttings taken at monthly intervals

internal mechanism, we hoped to determine the role of rooting cofactors in this seasonal response.

The evergreens we included in this study were — Dwarf Japanese yew (*Taxus cuspidata* 'Nana') and Andorra juniper (*Juniperus horizontalis* 'Plumosa'). Terminal cuttings were taken each month for one year. The cuttings were divided into 3 groups — 1 group received the natural photoperiod which varied with the season of the year, another group received a short photoperiod of 8 hours of daylight and the last group received a long photoperiod accomplished by 8 hours of natural light plus a 3 hour light interruption during the middle of the night. Within each photoperiod the cuttings were subjected to various IBA treatments — 1 group was not treated, another group received a 1.0% concentrated solution dip treatment, and the last group received a 2.0% treatment. The cuttings remained in the rooting medium for 3 months and were then measured for the percentage rooted and the number of roots initiated.

The effects of IBA on the per cent rooting and the number of roots initiated with Andorra juniper cuttings are shown in Fig. 1. If we first consider the non-treated cuttings we see a very definite seasonal response in the per cent rooting, with the optimum rooting occurring with cuttings taken in late fall to early spring. The IBA did not alter this seasonal pattern except to accentuate it. When the rooting potential was low IBA actually decreased the percentage rooted. This may be due to the high concentrations used and might not have been true for other concentrations. It does raise the question whether IBA should be used at the same concentration in all seasons or even at all in some seasons. The number of roots initiated also showed a definite seasonal trend with IBA stimulating initiation but only during late fall to early spring.

The effects of photoperiod on the rooting of Andorra juniper are shown in Fig. 2. In general there was very little difference between photoperiod treatments, either on the percentage rooted or the number of roots initiated. Again, the seasonal response is quite evident and it might be interesting to note at this time that in general, rooting was highest during the seasons when the junipers were dormant. The exception to this is the peak in July which might be related to the summer dormant period that many evergreens exhibit. However, this was not determined.

The effects of IBA on the rooting of Dwarf Japanese yew cuttings are shown in Fig. 3. There was a significant seasonal variation in rooting with both the per cent rooting and the number of roots initiated. Without IBA, the per cent rooting was low from April to August and then increased in September followed by a second increase and optimum rooting in November and December. Cuttings taken after December showed a definite downward trend in rooting. However, IBA applied during these winter and early spring months counteracted this trend and kept rooting at a high level until March. Another interesting effect of IBA was the inhibition of bud activity about this same time. IBA was rather ineffective at other times of the year in increasing either the percent rooted or the number of roots initiated.

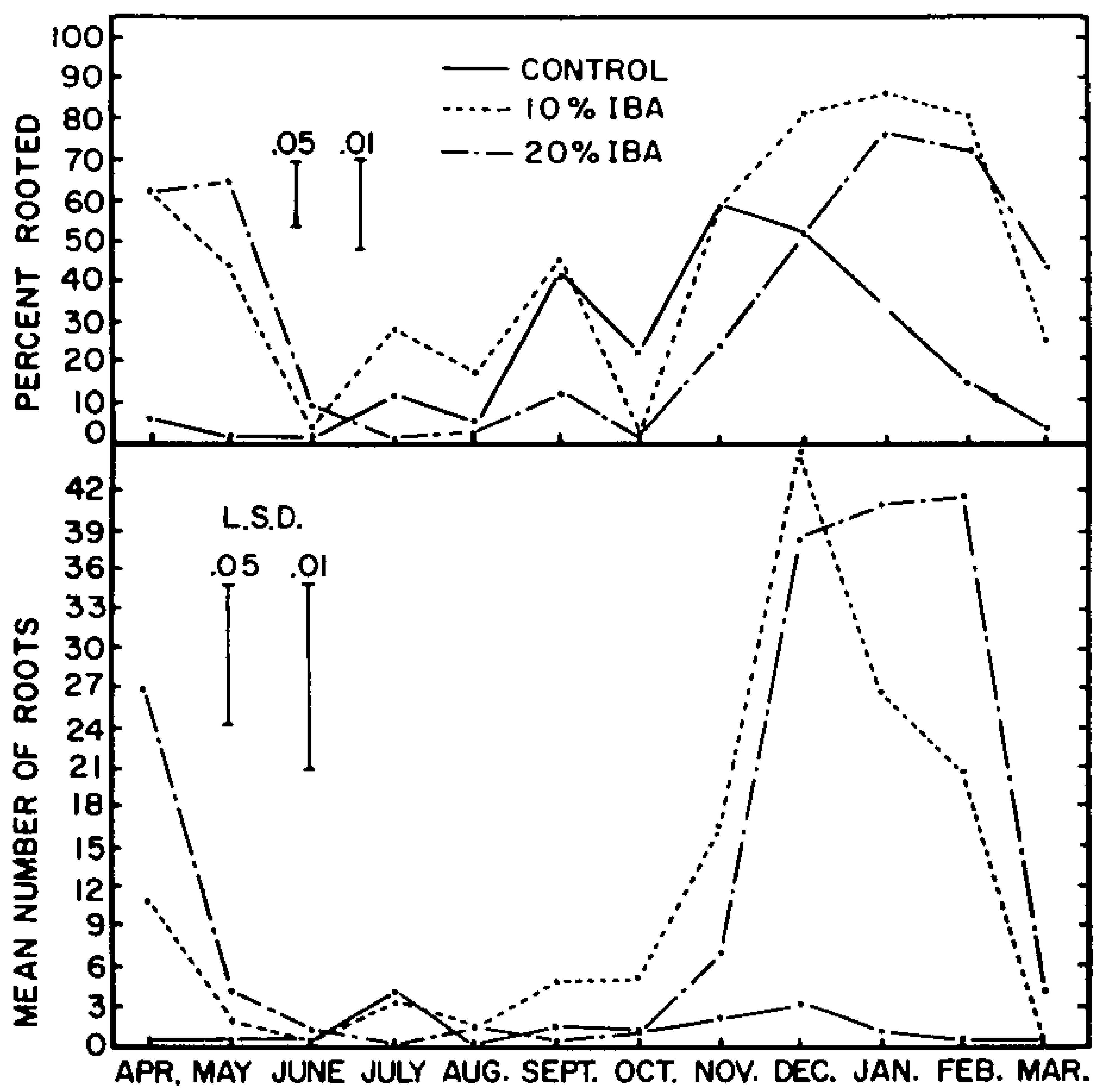

Fig. 3. The effect of IBA on rooting of Dwarf Japanese yew cuttings taken at monthly intervals.

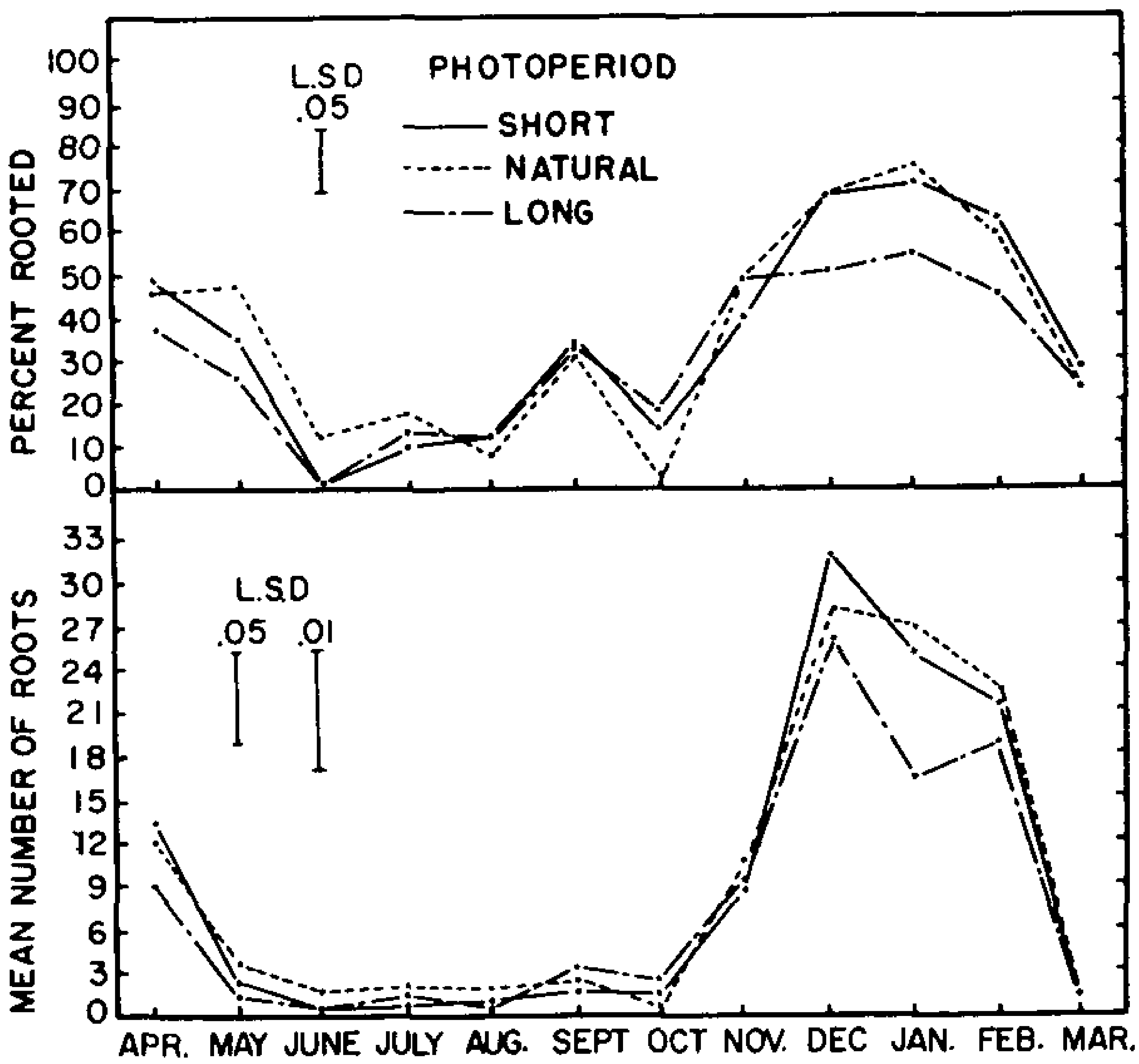

Fig. 4 The effect of photoperiod on the rooting of Dwarf Japanese yew cuttings taken at monthly intervals.

The effects of photoperiod on this seasonal trend in rooting of Japanese yew are shown in Fig. 4. Again the seasonal pattern is quite apparent, especially on root-initiation. The only time that photoperiod had any significant effect was during the winter months when the long photoperiod reduced the rooting of the yew cuttings. This inhibition of rooting due to the long photoperiod was noticed when the cuttings were taken in December through February, but at no other time. Not only did the long photoperiod inhibit rooting but it also was observed to stimulate bud activity, as might be expected. However, the photoperiod effect on rooting only existed if the cuttings had not been treated with IBA, as shown in Fig. 5. This interaction between photoperiod and IBA on rooting and bud activity suggests

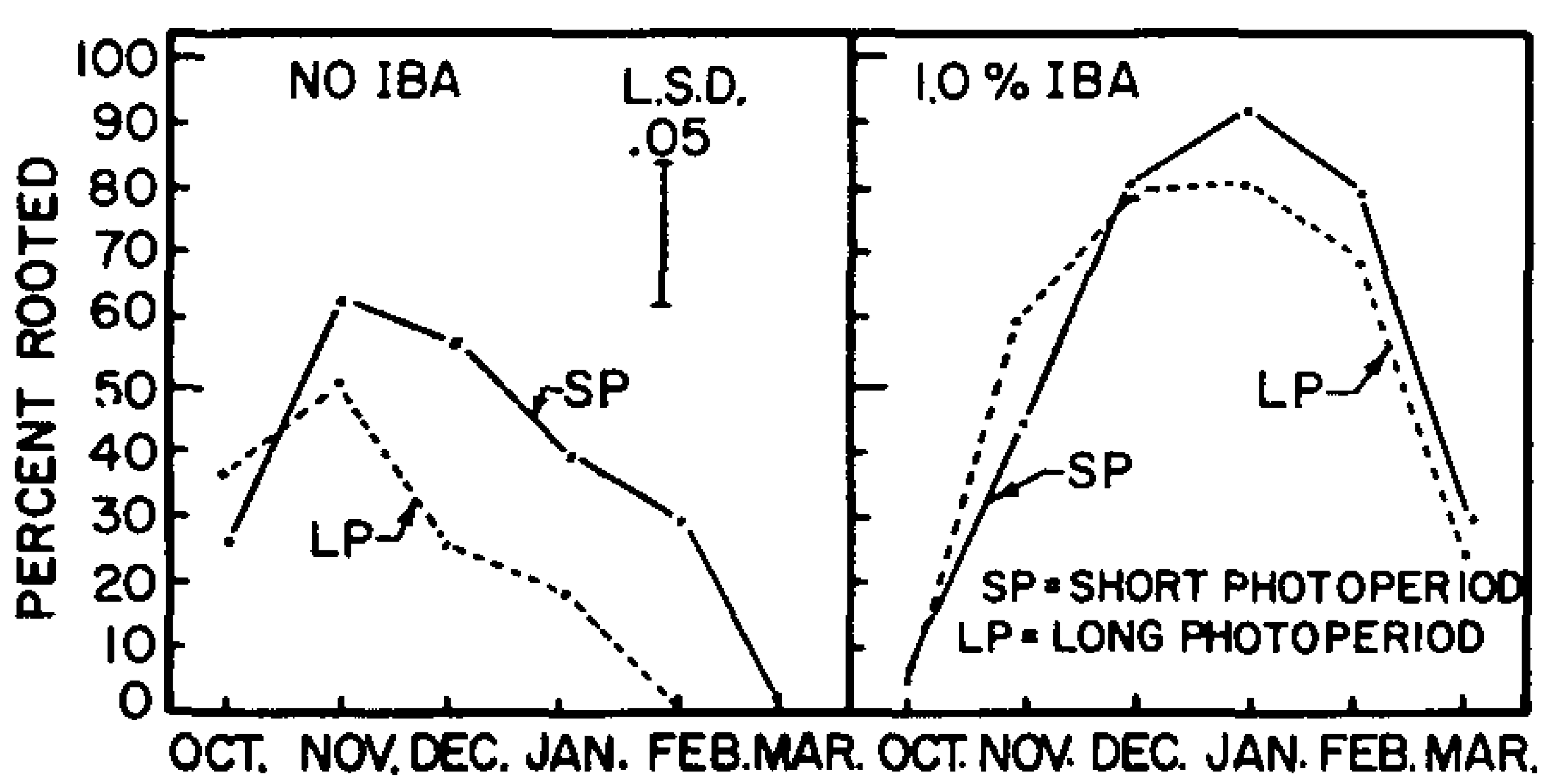

Fig. 5. The interaction of photoperiod on IBA on the percentage rooted of Dwarf Japanese yew cuttings taken monthly from October to March.

some interesting possibilities for the cause of the seasonal response. It appears that factors which stimulated growth of these evergreens, such as the long photoperiod, inhibited rooting, whereas factors that inhibited growth, such as IBA, stimulated rooting. This also coincided with the seasonal rooting pattern, since rooting was highest during the dormant period and lowest during the actively growing period.

We now come to the question of what are the internal processes causing this seasonal rooting response. We investigated the role of rooting cofactors using the test developed by Hess (1). If the rooting cofactors were responsible for this seasonal rooting response we would expect to find a reduction in the concentration of one or more of the cofactors in those seasons when rooting was low. We found that this was not the case in our studies with Andorra juniper. Although we were able to distinguish 4 active cofactor areas similar to those reported by Hess (1) we did not observe any changes in their concentration that correlated with the seasonal rooting response. However, the presence of the rooting cofactors in the foliage may reveal the rooting potential of a particular species, but does not necessarily assure their availability at the site of root initiation. What we are suggesting is that the critical factor in the seasonal response may be whether these cofactors are translocated to the site of root initiation, which perhaps may be dependent on whether the cutting is in an actively growing phase or a dormant stage. It is also possible that the seasonal response is due to changes in carbohydrate reserves or other substances essential for rooting. The question of what controls the seasonal rooting response still remains unanswered.

In summary, the root forming capacity of cuttings of Andorra juniper and Dwarf Japanese yew was highest during the period from late fall to late winter. IBA stimulated rooting but only when the root forming capacity was high. Photoperiod had very little effect on the rooting of Andorra juniper but with Japanese yew a long photoperiod during the late winter months decreased rooting if the cuttings had not been treated with IBA. It appears that the seasonal rooting response and the effects of IBA and photoperiod were directly or indirectly related to the growth phase. Conditions which tended to stimulate active growth inhibited rooting whereas inhibition of growth was associated with an increase in rooting.

LITERATURE CITED

1. Hess, Charles E. 1960 A Study of Plant Growth Substances in Easy and Difficult-to-Root Cuttings. Proceedings Tenth Annual Meeting Plant Propagators Society.
2. Lanphear, F. O and R P. Meahl 1961 The Effect of Various Photoperiods on Rooting and Subsequent Growth of Selected Woody Ornamntal Plants Proc Amer. Soc Hort Sci 77.620-634.
3. Piringer, A A. 1961 Photoperiod, Light and Rooting Cuttings. Proceedings Second Annual Meeting Western Plant Propagators Conference
4. Waxman, Sidney. 1955. The Effect of Length of Day on the Growth of Woody Plants Proceedings Fifth Annual Meeting Plant Propagators Society