Branch Induction with Cytokinin to Improve Appearance and Increase Cutting Production of Jojoba

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ABSTRACT

Treatment of jojoba plants with foliar sprays of benzyladenine (BA) alone, or in combination with gibberellin$_{4+7}$ (GA_{4+7}) greatly increased branching frequency compared to untreated control plants and to plants from which all shoot tips were removed (pinched). Use of BA by itself resulted in an adverse reduction in internode elongation. This was overcome in treatments which included GA_{4+7}. Use of GA_{4+7} by itself resulted in reduced branching and abnormal shoot elongation. Pruning (pinching) of all shoot tips resulted in a slight increase in branching over untreated plants, but it had much less effect on branching than did treatments with BA. Results were very similar on two different clones tested.

INTRODUCTION

Jojoba is increasingly used as a landscape plant in the Southwest. A native of the Sonoran desert, it is somewhat unusual in that it is an evergreen broadleaf shrub. Most other shrubs and trees of the desert have small leaves or go seasonally deciduous. As a broadleaved evergreen jojoba lends itself to wind and dust reduction, to screening out unwanted views, and as a relatively uniformly colored foundation plant against which to set off other, more noticeable plants. While fitting into a wide range of functional uses, it requires little care, and almost no irrigation once it is established.

Jojoba is a dioecious plant, having male and female individuals, and a great diversity of forms exist. From a landscaping viewpoint, one of the important variations is in plant density. While some plants are naturally quite dense, and as a result relatively attractive, many individuals have a very open branching habit. Such plants tend to be less attractive, and they function poorly in wind and dust control, or as screening plants. Poor appearance is especially a problem with young seedlings in containers (1 to 2 years of age), which tend to have only a few branches and which consequently do not sell as well as they otherwise might.

One approach to solving this problem is through breeding and/or selection of genetically dense plants followed by asexual propagation. A second approach is to use pinching or application of branch inducing chemicals at an early stage to increase branch production. Benzyladenine (BA), and/or BA plus Gibberellin$_{4+7}$ (GA_{4+7}) have been used on a number of plant species for branch induction, and have been shown to be effective in most cases (1,2,3).

The objective of this study was to evaluate pinching (removal of all shoot tips) and several concentrations of BA and GA_{4+7}, alone and in combination, on branch induction of jojoba. A secondary benefit of increased branching could be increased cutting production from plants being used as stock plants for cutting propagation. Use of plant growth regulators on stock plants has recently been reviewed (4).

MATERIALS AND METHODS

One-year-old plants (rooted cuttings) of two jojoba clones were sprayed to run-off with BA, GA_{4+7}, and Promalin (a mixture of BA and GA_{4+7} produced by Abbott Labs), at three concentrations of active ingredients; 100, 200 and 300 ppm. In addition to the 9 growth regulator treatments, an untreated control treatment was included, as well as a treatment in which all terminals were pinched from the plants. For each clone, 4 replications of each treatment were used with 2 plants per replicate. Both prior to and after treatment, plants were grown in a double-poly greenhouse.

The two clones which were selected were chosen based on a natural difference in branching habit; Clone 1487 has an average branching frequency (no. of branches/no. of nodes) of 0.30, which means that a branch normally forms at approximately every third node. Clone 1310 has an average branching frequency of 0.49, which means that a branch normally forms at every other node.

RESULTS

Data on average number of branch tips per plant for the eleven different treatments are given in Table 1. Response to some treatments was observed within one week of treatment, however, the data presented were collected after 6 weeks.

	Number of Branches			
	Clone 1487		Clone 1310	
Treatment	Ave.	Range	Ave.	Range
Control	7.5	5 to 12	15.4	10 to 20
Pinching	9.8	6 to 14	17.0	10 to 24
Benzyladenine (BA)				
100 ppm	26.5	18 to 42	36.5	15 to 45
200 ppm	29.4	18 to 37	48.1	36 to 60
300 ppm	26.0	21 to 33	36.6	11 to 52
Gibberellin (4+7) (GA)				
100 ppm	5.6	3 to 7	10.5	4 to 18
200 ppm	6.1	3 to 9	9.3	4 to 12
300 ppm	6.3	3 to 12	8.6	3 to 14
BA + GA				
100 ppm	26.0	20 to 32	33.6	21 to 45
200 ppm	23.5	15 to 31	25.4	15 to 33
300 ppm	17.9	7 to 38	22.0	16 to 29

For Clone 1487, all levels of BA caused a 3- to 4-fold increase over the untreated control plants in the number of branches; the middle concentration, 200 ppm, gave the largest response; 29.4 branches vs. 7.5 for control plants. While BA greatly increased branching, most of the newly formed branches were very short, with greatly reduced internode length.

Newest internode lengths on untreated plants were 2 to 3 cm long, while those of the BA-treated plants were only about 1 cm long. Very similar responses to BA were found with Clone 1310. Again, the largest effect was found at the 200 ppm level; 48.1 branches vs. 15.4 for control plants. As was mentioned earlier, Clone 1310 naturally branches more. This is reflected in the values for untreated plants of Clone 1487 of 7.5 and for Clone 1310 of 15.4.

The combination of BA and GA_{4+7} also greatly increased branching at all concentrations and for both clones tested; however, the effect was somewhat less than with BA alone. The combination overcame the dwarfing effect on new branches that is caused by BA alone; with the combination, new internode lengths were in the range of 2 to 3 cm, which is about the same as the untreated control plants. The combination of the two materials did cause some foliar damage, especially at the highest concentration. This toxicity likely caused the almost linear drop off in branching with increasing concentration.

As expected, GA_{4+7} by itself did not increase branching frequency, instead, it actually caused reduced branching. This was likely due to the fact that it caused abnormal internode elongation of growing internodes, and such growth used plant resources which could otherwise have been used in new branch production. Internode length of the newest internodes of GA treated plants was as long as 5 cm.

Somewhat surprisingly, pinching of all shoot tips had much less of an effect on branch induction than did the treatments which included BA. Pinching resulted in only 1.1 and 1.3 times as many branches as the untreated control plants of clones 1310 and 1487, respectively. In most cases, the net effect of pinching was that, on average, between 1 and 2 of the axillary buds further down on the stem would start to grow. With BA treatments, between 3 and 4 of these buds grew.

REFERENCES

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