EFFECT OF INDOLE BUTYRIC ACID CONCENTRATIONS ON THE ROOTING OF KIWI CUTTINGS

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ABSTRACT
Effect of different IBA concentration on the rooting of Kiwi cuttings (Cv: Hayward and Abbott) was investigated at Agricultural Research Station, Mingora, Swat during 2003. The callused cuttings of both sexes were treated with 0, 3000, 4000, 5000 and 6000ppm of IBA. The results revealed that cuttings of both cultivars treated with 4000ppm, showed good results on percent plant survival, number of roots per plant, root length, root weight, root diameter, number of leaves and shoot diameter.

INTRODUCTION
Kiwi (Actinidia chinensis) also known as chinese goose berry, monkey peach or sheep peach is a rich source of Vitamin C having higher contents than citrus and is dioecious in nature. It is a large, vigorous, woody deciduous vine and can reach over 10 meters in length. It starts bearing in 3rd year while commercial bearing starts up to 5th year (Miller, 1975). The fully ripe flesh is green, slightly acidic, melting and delicate in flavor, and contains numerous small brown seeds. The skin colour of the fruit does not change during maturation, therefore, optimum harvest maturity is difficult to determine. They will remain on the vine for considerable length of time after full maturity but the best quality fruits are those, which are fully grown and just yield to pressure but are not too soft. Optimum harvest maturity is reached when the soluble solid content of the flesh has reached 8% (Pratt and Reid, 1974). Fruits are hand harvested. They break readily at the abscission layer, which is the natural breaking point of the fruit stalk (Fletcher, 1971). The fruits can be stored for 5-7 months at 0- 6°C with high humidity (Ravenhill, 1969). In Pakistan harvesting is usually done in the month of November, however, too early harvesting is not required though the fruit look mature, because it takes some time for the internal flesh to sweeten and soften.

Kiwi fruit can be propagated from seed or hard wood cutting but seedling are not recommended because of its dioecious nature as the sex is unknown until flowers are produced. Rana et al. (1999) treated Kiwi cuttings with 500ppm IBA in spring season and found 57% rooting response. Abdel-Hussain and Salman (1988) concluded that wounding plus IBA treatment at 4000ppm gave the highest rooting percentage and greatest number of roots, root length and individual root weight of cuttings. Daud et al. (1989) reported that dipping the cutting in 2000, 3000 and 4000 ppm IBA gave the highest rooting percentage and greatest number of roots, root length and individual root weight of cuttings. Daud et al. (1989) reported that dipping the cutting in 2000, 3000 and 4000 ppm IBA gave the highest number of roots. The effect increased with increasing IBA concentration. Kiwi cuttings are hard to root, therefore, the present study was initiated to study the effect of different concentrations of IBA on the performance of kiwi fruit cuttings.

MATERIALS AND METHODS
The research study was conducted at Agricultural Research Station (N), Mingora, Swat during 2003. The experiment was laid out according to Completely Randomized Design with three replications. There were ten cuttings of each sex {Male (Hayward) and Female (Abbott)} in each treatment. Treatments were control, 3000, 4000, 5000 and 6000 ppm IBA. Twenty cm long hardwood cuttings of both sexes were kept in hot bin for 35 days at 20°C for callus formation and then dipped in different concentrations of IBA for five seconds before planting in polythene bags on 10th March 2003. The medium utilized was forest soil (decomposed pine leaves).

The study lasted for six months, cuttings were regularly observed and the data were recorded on percent sprouting by converting the average sprouting into percent. The survival percent was calculated by following formula.

Survival % = \frac{\text{Cutting survived}}{\text{Cuttings sprouted}} \times 100

Root number was counted on each plant and their length was measured with measuring tape and then weighed. Leaves were counted on each plant and increase in stem diameter was taken by vernier caliper at sprouting time.

RESULTS AND DISCUSSION
Percent Sprouting
No significant difference was observed in sprouting among various IBA concentrations (Table I and II). All cuttings of male and female plants were sprouted. The non significant difference in sprouting may be due to sufficient stored food materials in cuttings.

Percent Survival
Cuttings of male plants treated with 4000 ppm IBA gave highest survival percent (33.3). In female cuttings the difference in survival was non significant. No success was recorded in control for both sexes. The highest survival by treating cutting with 4000 ppm IBA may due to more number of roots. While no success in control is due to failure of rooting. Kiwi is hardy to rooting and treating with
IBA helped in root initiation. The findings are in partial agreement with the findings of Rana et al. (1999) who treated Kiwi cuttings with 5000 ppm IBA and obtained 57% rooting response.

Number of Roots Plant
The number of roots per plants was significantly affected by different concentrations of IBA for the cuttings of both sexes (Table I and II). The difference in number of roots in cuttings treated with different concentration of IBA was non significant in both sexes. However maximum number of roots (5) were recorded for both male and female cuttings treated with 4000 and 5000 ppm, while no rooting was observed in control. It could be due to the effect of IBA as it increases cell wall plasticity and cell division stimulates callus development and root growths (Weaver, 1972). The increase in IBA concentration above 4000ppm caused decrease in number of roots.

Root Length
The data presented in Table I and II show significant difference in root length of both sexes treated with IBA concentration. Cuttings of male and female plants treated with 4000/ppm IBA solution gave the highest root length of 16 and 15 cm respectively. In both sexes, the difference in root length by treating cuttings with 3000, 4000 and 5000 ppm was non significant and root length decrease with further increase in concentration. IBA promote cell elongation which helped in increase in root length.

Root Weight
It is evident from Table I and II that different concentrations of IBA had significant effect on root weight. The maximum root weight (2.3 g) for both sexes was noted with 4000/ppm followed 2.1 g and 2.0 g/plant with 3000 and 5000 ppm IBA for male cuttings and 2.0 and 1.8g in 5000 and 3000ppm respectively for cuttings taken from female plants. The difference in root weight was non significant by treating cuttings with 3000,4000 and 5000ppm IBA in both sexes. The increase in weight of root is due to more number and length of roots.

Root Diameter
Statistical analysis of the data in Table I and II revealed that root diameter was significantly affected by different concentrations of IBA at 5% level of probability for both sexes. The maximum root diameter (3.0 cm) was observed for the cuttings of both male and female, treated with 4000 ppm of IBA followed by 2.8 cm in 5000 ppm while complete failure was noted in control. The increase in root diameter may be due to more vegetative growth and accumulation of carbohydrates.

Number of Leaves
The data presented in Table I and II reveal that number of leaves was significantly enhanced with different IBA concentrations, in both sexes. Maximum number of leaves (11 and 13) for male and female cuttings respectively was recorded with 4000ppm. It may be due to vigorous root system which enhanced the absorption of mineral and water from the soil and enhanced the vegetative growth.

Shoot Diameter
Shoot diameter was significantly affected by IBA concentrations at 5% level of probability in both sexes (Table I and II). The diameters of shoots increased only up to 4000 ppm IBA and decreased with increase in IBA concentration. High shoot diameter of 4.0 and 4.3 cm was observed in male and female cuttings respectively, treated with 4000 ppm of IBA. The increase in shoot diameter might be due to more number of leaves and vigorous root system, which might have resulted in more carbohydrate production and assimilation.

CONCLUSION AND RECOMMENDATION
In the light of experimental results both sexes treated with 4000/ppm produced significant results on percent plant survival, number of roots per plant, root length, root weight, root diameter, number of leaves and shoot diameter. Therefore, 4000/ppm IBA is recommended for rooting of kiwi cuttings.
Table I. Effect of IBA concentrations (dip method) on various parameters of male Kiwi plant Hayward cutting.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>% Sprouting</th>
<th>% Survival</th>
<th>No. of roots/plant</th>
<th>Root length (cm)</th>
<th>Root weight (g)</th>
<th>Root diameter (cm)</th>
<th>No. of leaves</th>
<th>Shoot diameter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>100</td>
<td>0.0c</td>
<td>0.0b</td>
<td>0.0c</td>
<td>0.0c</td>
<td>0.0d</td>
<td>0.0d</td>
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<tr>
<td>3000 ppm</td>
<td>100</td>
<td>16.67abc</td>
<td>4.0a</td>
<td>15.0ab</td>
<td>2.1ab</td>
<td>2.6a</td>
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<td>4000 ppm</td>
<td>100</td>
<td>33.33a</td>
<td>5.0a</td>
<td>16.0a</td>
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<td>11.0a</td>
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<td>5000 ppm</td>
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<td>23.33ab</td>
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<td>14.0ab</td>
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<td>9.0ab</td>
<td>3.5b</td>
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<tr>
<td>6000 ppm</td>
<td>100</td>
<td>10.00bc</td>
<td>4.0a</td>
<td>13.0b</td>
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<td>6.0c</td>
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<td>LSD at 5%</td>
<td>N.S</td>
<td>18.1</td>
<td>2.3</td>
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<td>0.5</td>
<td>0.9</td>
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</table>

Table II. Effect of IBA concentrations (dip method) on various parameters of female Kiwi plant Abbot cutting.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>% Sprouting</th>
<th>% Survival</th>
<th>No. of roots/plant</th>
<th>Root length (Cm)</th>
<th>Root weight (g)</th>
<th>Root diameter (Cm)</th>
<th>No. of leaves</th>
<th>Shoot diameter (Cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
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<td>00</td>
<td>0.0b</td>
<td>00c</td>
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<td>4.0a</td>
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<tr>
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<td>3.0a</td>
<td>13.0a</td>
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<tr>
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<td>13ab</td>
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<td>LSD at 5%</td>
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<td>N.S</td>
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REFERENCES


