Effect of Promalin on physical attributes of apple cv. Red Delicious

ZA Bhat, TR Rather, Kounser Javeed, HU Itoo, Sheikh Khursheed, GH Rather, Shemoo Nisar, Shahzad Ahmad Bhat and Qudsiya Ayaz

Abstract
The present study was conducted at AARC to determine the response of the Promalin on the growth of apple (Malus domestica Borkh) cv. Red Delicious. The study shows that the growth of apple fruit was significantly influenced by Promalin (GA4+7 and 6 BA). Among the different treatments, maximum fruit set of 15.89% was recorded with treatment T5 which was at par with treatment T4, however, minimum fruit set of 3.34% was obtained in higher dose (phytotoxic). The longest fruit of 71.06 mm was recorded with T4 which was at par with T3, T5 and T7 whereas the control (Water spray) had fruit of length 60.52 mm and was significantly different from all the treatments. During the investigation, fruit breadth of 70.70 mm was obtained with treatment T5 which was at par with T4, whereas the control (Water spray) had fruit of least breadth 61.34 mm. Maximum fruit colour was observed with lower concentrations of chemical and untreated fruits as compared to high concentration. With higher concentration of chemical, the fruits developed long conical shape (a market driven factor). The data revealed that the chemical sprays did not cause russetting except the phytotoxic concentration which resulted in about 12.67% russetting in treated fruits. No phototoxic symptoms were observed during the course of investigation on fruit or plant.

Keywords: Promalin, russetting, phototoxic, symptoms, fruit set

Introduction
In the commercial production of apple various fruit growth regulators (PGR) are used. These PGR are used for the purpose to increase fruit size and to change fruit shape in some cases. Few examples of those PGR are Cytokinins and Gibberellins. Application of Cytokinins and Gibberellins on the fruit increases the cell division during early stage of the fruit growth and also changes the shape of the fruit. Promalin is a mixture of PGR which contains 6-Benzyl adenine and Gibberellic Acid 4+7 and it is used commercially in apple production. Application of Promalin during early stage of flowering and fruit development alter the shape of the fruit from oblate to elongate as it enhances the cell division in calyx region. Clearly showing, the use of PGRs increases the fruit growth rate or the surface expansion rate and final fruit size. The quality of fruit of an apple is adamant by its taste, aroma, color and shape, which is attained by each particular variety of apples. According to Marcelle (1995) [11], the ration of fruit height/diameter (H/D) comprises a factor of fruit quality. The lack of typical shape was considered a marketing disadvantage. Before the harvest diverse range of manipulations and treatments can reduce such deformities. Promalin which is a mixture of GA4+7 and Benzyl adenine improves the shape of the fruit as it did chemical thinning at the end of the flowering Period (William, 1978, Burak and Buyukyilmaz 1997) [15, 3].

Materials and Methods
The experiment was carried out at AARC for two consecutive years i.e., 2017 and 2018. The study was carried out on 20-22 years old apple plants cv. Red Delicious. Trees of uniform size, age and vigour were selected. The selected plants were labeled and grouped into seven treatments having three replications under randomized block design. Plants were kept under uniform cultural operation including irrigation, fertilization, insect-pests and disease control during the entire period of investigation.

Calculated dose of product (Code-347) was applied as per the treatment details given in the table at different stages of crop growth. Fruits were harvested in the month of October.

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Observations were recorded on different parameters of the fruit physical characters. Total number of the fruits from an individual plant was counted at the time of harvesting. Yield from individual plants were calculated by weighing all the fruit of a single plant and expressed in kg/plant. Five fruits from each replication were taken and weighed on the digital weighing balance and averaged value was worked out and expressed in grams. Same five fruits were taken for fruit length and breadth using a Vernier Caliper and averaged value was worked out and expressed in millimeters (mm). The data generated from these investigations were appropriately computed, tabulated and were analyzed by applying Randomized Block Design Factorial (RBD).

Results and Discussion

Fruit set (%)
Significant differences were recorded in fruit set percentage among the different treatments. During course of testing maximum fruit set of 15.89% was recorded with treatment T5 which was at par with treatment T4, however, minimum fruit set of 3.34% was obtained in higher dose (phytotoxic). The Data depicted in table 1, revealed that the agro-chemical under testing had positive impact on fruit set. The comes about show that there's positive relationship between the chemical and fruit set as with increment within the concentration of chemical there was comparing increment within the fruit set up to a concentration of 90 ppm. A part of data has risen with respect to the impacts of gibberellins and cytokinins on fruit development and growth (Argenta et al., 1991; Argenta et al., 1993).

Fruit length (mm)
The longest fruit of 71.06 mm was recorded with T4 which was at par with T3, T5 and T7 whereas the control (Water spray) had fruit of length 60.52 mm and was significantly different from all the treatments. The data presented in table 1 revealed that there is significant increase in fruit length with the chemical treatments in comparison with control. GA4+7 + BA applied at blossoming have been appeared to extend fruit size and the fruit L/D proportion, and decrease russetting (Jindal et al., 2004 and Greene, 2003). The fruit size increment may be a result of the acceptance of cell division and elongation, and the increment in fruit length (Burac and Buyukylmaz, 1997; Looney, 1996).

Fruit breadth (mm)
During the investigation, fruit breadth of 70.70 mm was obtained with treatment T5 which was at par with T4, whereas the control (Water spray) had fruit of least breadth 61.34 mm. The data presented in table 1, revealed that that there is significant increase in fruit breadth with the chemical treatments during course of testing in comparison with control. Taylor and Knight (1986), looking at the impacts of gibberellins, watched that they increased the size of the epidermis cells, giving 25% more plasticity when the cuticle was submitted to a stress. Promalin dose may be split into two or more applications, which must be made up to two weeks after petal fall.

Fruit Colour (%)
Maximum fruit colour was observed with lower concentrations of chemical and untreated fruits as compared to high concentration. T2 All the treatments had at par colour percentage, however the phytotoxic dose had least colour development. Our results are in conformity with McGuire, 1992 who demonstrated that GA4+7 furthermore 6-BA treated fruit had a lighter and somewhat more yellow become flushed colour with marginally greener foundation colour. Our comes about are in assention with Cline, 2006 who detailed a straight increments in blush colour 'b' values (P=0.013) and hue angle values (P=0.024), both with expanding rates of GA4+7 additionally 6-BA.

Fruit shape
The perusal of data (table-1) clearly indicates that the chemical treatments had significantly affected the fruit shape. With higher concentration of chemical, the fruits developed long conical shape (a market driven factor). T3, T4, T5 and T7 had long conical fruits as compared to other treatments that produced conical fruits only. In mild climate regions, where fruit shape is risky, growth regulators may adjust this issue (Looney, 1996). Promalin is utilized for fruit elongation at 1.17 to 2.34 L ha-1 when the central (king) flower opens, expanding its impact and its thinning capacity if a surfactant is included (Greene, 2003). The fruit shape was prolonged when treated with promalin (Demetrios et al., 2004).

Table 1: Effect of Promalin on physical parameters of Apple cv. Red Delicious

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fruit set (%)</th>
<th>Length (mm)</th>
<th>Breadth (mm)</th>
<th>Fruit Color (%)</th>
<th>Fruit Shape</th>
<th>Fruit Russetting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (T1)</td>
<td>5.58</td>
<td>60.52</td>
<td>61.34</td>
<td>84.21</td>
<td>C</td>
<td>Nil</td>
</tr>
<tr>
<td>10 ppm (T2)</td>
<td>12.74</td>
<td>65.84</td>
<td>66.53</td>
<td>84.10</td>
<td>C</td>
<td>Nil</td>
</tr>
<tr>
<td>30 ppm (T3)</td>
<td>14.51</td>
<td>69.11</td>
<td>67.26</td>
<td>83.61</td>
<td>LC</td>
<td>Nil</td>
</tr>
<tr>
<td>60 ppm (T4)</td>
<td>15.08</td>
<td>71.05</td>
<td>69.57</td>
<td>83.08</td>
<td>LC</td>
<td>Nil</td>
</tr>
<tr>
<td>90 ppm (T5)</td>
<td>15.89</td>
<td>69.98</td>
<td>70.70</td>
<td>82.83</td>
<td>LC</td>
<td>Nil</td>
</tr>
<tr>
<td>180 ppm (T6) (Phytotoxic conc)</td>
<td>3.34</td>
<td>61.10</td>
<td>62.56</td>
<td>78.86</td>
<td>C</td>
<td>12.67%</td>
</tr>
<tr>
<td>100 ppm (T7)</td>
<td>12.96</td>
<td>68.54</td>
<td>66.37</td>
<td>83.93</td>
<td>LC</td>
<td>Nil</td>
</tr>
<tr>
<td>CD</td>
<td>1.67</td>
<td>1.87</td>
<td>2.09</td>
<td>1.97</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Fruit russetting
The data revealed that the chemical sprays had not cause russetting except the phytotoxic concentration which resulted in about 12.67% russetting in treated fruits. The mode of action in russetting reduction is related to the control of the epidermis cell elongation, resulting in a fruit cuticle less prone to cracks (Eccher, 1978). For russetting control, the phytoxic symptoms were observed during the course of investigation on fruit or plant. No chemical treatment except the phytotoxic dose showed any phytoxic symptom.
### Table 2: Phytotoxicity

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Wilting</th>
<th>Vein Clearing</th>
<th>Necrosis</th>
<th>Epinasty</th>
<th>Hyponasty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 - 10</td>
<td>0 to 10</td>
<td>0 to 10</td>
<td>0 to 10</td>
<td>0 to 10</td>
</tr>
<tr>
<td>T1</td>
<td>Control</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T2</td>
<td>10 ppm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T3</td>
<td>30 ppm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T4</td>
<td>60 ppm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T5</td>
<td>90 ppm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T6</td>
<td>180 ppm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>T7</td>
<td>100 ppm</td>
<td>-</td>
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</tr>
</tbody>
</table>

**Conclusion**

The chemical had significant impact on fruit set, size and shape. The chemical sprayed at concentration 60ppm/l had significant impact on fruit quality characteristics. At 30ppm/l concentration the results are also significant, however at 60ppm/l the results are more encouraging so that farming community can harvest the benefits of the above tested chemical.

**References**


