PHYSIOLOGICAL AND BIOCHEMICAL CHANGES IN FLORAL BUDS OF MANGO (MANGIFERA INDICA L.) TREATED WITH DORMEX (HYDROGEN CYANAMIDE)

D. PANDEY, S.N. PANDEY AND P.B. VARADE

Division of Fruits and Horticultural Technology, Indian Agricultural Research Institute, New Delhi-110012

Received on 25 April, 1998, Revised on 18 March, 1999

Study on the effect of Dormex (hydrogen cyanamide) on the physiological and biochemical status of floral bud of mango cv. Samarbehist Chowsa revealed that buds treated with Dormex @ 1% a.i. applied at the time of flower bud differentiation in October showed higher contents of ABA, GA₃, calcium, potassium, magnesium, iron, sodium and C/N ratio and lower contents of IAA, nitrogen, phosphorus, copper, manganese, zinc, total protein and total organic carbon than the untreated control buds.

Key words: ABA, C/N ratio, IAA, mango, flowering.

Mango malformation is a serious malady causing great concern and heavy losses. Of the two types of malformation i.e., floral and vegetative, the former causes heavy losses in yield. It is characterized by the deformation of panicles, suppression of apical dominance, shortened primary and secondary axes, thickened rachis of panicles (giving the flowers a characteristically clustered appearance) and a preponderance of staminate and large flowers. Such panicles seldom set fruits, ultimately dry up and persists on the tree for the longer time (Singh et al., 1994). The malady has attracted the attention of many research workers and has been attributed to mite (Narsinhan, 1959), viral (Satter, 1946), pathological (Sumanwar et al., 1966), physiological and biochemical (Singh and Dhillon, 1993) causes. Likewise, various control measures such as use of plant growth regulators, phenolic compounds, antiethylene compounds, antimalformins, deblossoming with or without plant growth regulators, nutrient application and pruning have been suggested (Kumar et al., 1993). However, the precise cause and control are yet to be established. Recent studies indicated that floral malformation was significantly increased with application of Dormex (Pandey, 1996). However, the detailed physiological and biochemical studies in Dormex treated floral buds was not made in the past to understand its possible involvement in increasing floral malformation. Hence, the present study was undertaken to see the effect of Dormex on the physiological and biochemical changes in floral buds of mango cv. Samarbehist Chowsa.

The present study was undertaken in the Division of Fruits and Horticultural Technology, IARI, New Delhi during the year 1994-95. About 37 years old trees of ‘Samarbehist Chowsa’ maintained under uniform cultural operations were sprayed to runoff stage with different concentrations of hydrogen cyanamide at the time of flower bud differentiation in the second week of October. Tween-20 was added as a sticker to spray solution. The experiment was laid out in the randomized block design with four treatments replicated five times keeping single tree as a treatment unit.

The apical floral buds in treated and control plants were sampled at the bud-burst stage, oven dried at 60°C after washing with distilled water, ground and stored in the polythene bags for estimation. Nitrogen was estimated using a Technicon Autoanalyser (Warner and Jones, 1970), phosphorus (Champman and Pratt, 1961), potassium, calcium and sodium by flame photometer (Jackson, 1967), magnesium, copper, manganese, zinc and iron by Atomic Absorption Spectrophotometer.
D. PANDEY, et al.

(Tandon, 1994), total organic carbon (Wallacey and Black, 1934) and total protein by multiplying nitrogen content with a factor of 6.25 (Plumer, 1967). Plant hormones viz., indole-3-acetic acid, gibberellic acid and absciseic acid were estimated using GLC.

The plant samples were extracted in aqueous methanol (80% v/v) and purified as per method suggested by Sindy and Ornin (1975). The methyl ester of purified samples were prepared using diazomethane (Vogal, 1968). Similarly, the standard plant hormones were also derivatized before GLC analysis. The standard plant hormones used were ABA (Sigma Chemical Co, USA), IAA (E. Merck, Germany) and GA₃ (Abott Laboratory, USA).

Methyl derivative sample (0.3 μl) were injected into a Gas Chromatograph (Chemato) equipped with flame ionization detector and stainless steel column (3 mm x 100 cm, packed with 5% SE-30 coated on 80/100 mesh acid washed DMCA treated Chromosorb-W). The GLC was run under the following conditions. Hydrogen flow 0.1 bar, air flow 10 bar, nitrogen flow 1.2 bar, injector temperature 300°C and detector temperature 300°C with temperature programming started at 150°C and increased linearly to 300°C @ 10°C/min. The retention times of each standard plant hormones are given as under:

<table>
<thead>
<tr>
<th>Name of hormone</th>
<th>Retention time (min)</th>
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<tbody>
<tr>
<td>IAA</td>
<td>3.18</td>
</tr>
<tr>
<td>ABA</td>
<td>4.73 &amp; 5.14</td>
</tr>
<tr>
<td>GA₃</td>
<td>8.11</td>
</tr>
</tbody>
</table>

The total area and retention times were used for calculation of ABA.

The amount was calculated with the help of standard peak area and was expressed as μg g⁻¹ on fresh weight basis. The data were statistically analysed as per procedure given by Panse and Sukhatme (1967).

The content of total protein, total organic carbon and C/N ratio are presented in (Table 1) the perusal of table clearly shows that the level of C/N ratio was higher in treated buds compared to control. There is no unanimity on C/N ratios of malformed and healthy tissues (Pandey et al., 1973, Baghel et al., 1994). Higher C/N ratio may be responsible for the development of more staminate flowers in malformed panicles, suppression of flower development and fruit set (Majmder and Sinha, 1972).

**TABLE 1:** Total protein, total organic carbon and C/N ratio of Dormex treated 'Sambarbehist Chowsa' floral buds

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treated</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein (%)</td>
<td>14.79±0.91</td>
<td>18.12±0.48</td>
</tr>
<tr>
<td>Total organic carbon (%)</td>
<td>24.27±0.46</td>
<td>24.86±0.45</td>
</tr>
<tr>
<td>C/N ratio</td>
<td>10.35±0.83</td>
<td>8.57±0.15</td>
</tr>
</tbody>
</table>

The carbohydrates were invariably higher in shoots bearing malformed panicles as compared to those bearing healthy ones (Singh and Singh, 1992). Pandey et al., (1973) reported that higher level of carbohydrates in shoot bearing malformed panicles did not hydrolyze into sugar to meet their energy requirement. Contrarily, Singh and Dhillon (1993) reported higher levels of sugar and low levels of starch in malformed tissues suggesting that hydrolysis of starch into simple sugars was to meet the energy requirement for excessive growth of malformed panicles.

The total protein content was lower because of lower nitrogen content in treated floral buds as compared to control and in agreement with Pandey et al., (1975).

The nutrient status of treated and control buds (Table II) revealed that the effect of hydrogen cyanamide is nutrients specific. Treated floral buds had higher contents of N, P, Ca, Mn, and Zn as compared to control. Several workers (Abo-El-Dahab, 1975, Martin et al., 1975, Singh and Rajput, 1976) reported little differences in the mineral constituents of healthy and malformed tissues, although micronutrients deficiency particularly Fe and Zn have been reported to be associated with malformation but application of Fe, Zn or their chelates was shown to have no relationship with the control (Ram, 1991, Saeed and Schosser, 1972). Shoot carrying malformed panicles had lower level of nitrogen than the healthy tissue. Enhanced nitrogen application was found to curtail malformation whereas, addition of phosphorus and potassium increased the incidence significantly (Kanwar and Kalan, 1987). However, Bindra and Baketia (1971) did not find reduction in the malformation by nutrient application and concluded...
FLORAL BUD INITIATION IN MANGO

TABLE II: Nutrients status of Dormex treated 'Samarbehist Chowsa' floral buds.

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Treated</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (%)</td>
<td>2.36±0.14</td>
<td>2.90±0.08</td>
</tr>
<tr>
<td>Phosphorus (%)</td>
<td>0.52±0.04</td>
<td>0.64±0.02</td>
</tr>
<tr>
<td>Potassium (%)</td>
<td>0.20±0.61</td>
<td>0.15±0.08</td>
</tr>
<tr>
<td>Calcium (%)</td>
<td>1.56±0.86</td>
<td>1.07±0.07</td>
</tr>
<tr>
<td>Magnesium (%)</td>
<td>0.42±0.03</td>
<td>0.28±0.02</td>
</tr>
<tr>
<td>Iron (ppm)</td>
<td>354.43±5.20</td>
<td>218.86±4.69</td>
</tr>
<tr>
<td>Manganese (ppm)</td>
<td>33.70±1.62</td>
<td>38.98±0.84</td>
</tr>
<tr>
<td>Copper (ppm)</td>
<td>6.68±0.54</td>
<td>8.80±0.16</td>
</tr>
<tr>
<td>Zinc (ppm)</td>
<td>73.66±0.54</td>
<td>85.98±2.44</td>
</tr>
<tr>
<td>Sodium (ppm)</td>
<td>520±16±13.18</td>
<td>473±58±8.82</td>
</tr>
</tbody>
</table>

It is thus concluded that higher levels of GA₃, ABA and lower level of IAA by the application of Dormex are responsible for the higher production of floral malformation in mango.

REFERENCES


