

Yield and Quality of Aonla (*Emblica officinalis Gaertn.*) as Influenced by Foliar Application of Different Sources of Potassium with and without Urea Spray

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ABSTRACT

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An investigation was carried out on 15 years old plantation of Aonla (*Emblica officinalis Gaertn.*) cv. Chakaiya at Kumarganj, Faizabad (Uttar Pradesh) during the year 2013-14. In all, 8 treatments of foliar nutrients application viz. control (water spray), K₂SO₄ (2%), KCL (2%), KNO₃ (2%), K₂SO₄ (2%) + urea (2%), KCL (2%) + urea (2%), KNO₃ (2%) + urea (2%) and urea alone (2%) were tested in RBD replicated thrice. On total 24 trees of Aonla, manures and fertilizers were applied as per recommended schedule for aonla plantation. The treatments were applied twice i.e. after fruit set and at fruit bud development stages. The results obtained revealed that the treatment foliar application of H₂SO₄ + urea recorded minimum percent fruit drop, maximum per cent fruit retention, biggest fruit size, highest fruit weight, maximum pulp: stone ratio and TSS content in pulp, minimum acidity content, maximum vitamin 'C' content and percentage of total sugars and significantly highest fruit yield per tree among all treatments tried. It was followed by the treatment foliar application of KCL + urea in all fruit characters including yield. Lone spraying of K₂SO₄, KCL or KNO₃ could not prove significant superiority over control in most of the cases while urea alone spray was found significantly superior over control in almost all observations including fruit yield.

Introduction

Aonla (*Emblica officinalis Gaertn.*) is one of the most nutritious fruits and second richest source of vitamin 'C' after Barbados cherry. It is also a fair source of carotene, Thiamine, Riboflavin, carbohydrates and minerals like iron, phosphorus, calcium and magnesium. Among the commercial grown varieties, 'chakaiya' is the most popular due to its high bearing potential, late fruit maturity, medium fruit size, rich in vitamin 'C' content and prolonged shelf life. However, the severe fruit

dropping, poor fruit yield and incidence of nutritional fruit disorders have been observed in old Aonla plantation/ senile orchards which resulted in declining the cultivated area of Aonla in commercial growing fruit belts of eastern Uttar Pradesh. Foliar application of nutrients particularly N and K have been found more effective in improving the flowering, fruit set, fruit yield and fruit quality in Aonla crop (Singh *et al.*, 2009). In this view, the present study was undertaken to

increase the yield and quality of *Aonla* fruits with the help of foliar application of potassium and urea.

Materials and Methods

An investigation was carried out on 15 years old plantation of *Aonla* cv. Chakaiya at main experiment station, Department of Horticulture, N.D. University of Agric. And Tech., Kumarganj, Faizabad (Uttar Pradesh) during the year 2013-14. The 24 *Aonla* trees having uniform growth were selected randomly for the study. The cultural operations and basal application of manures and fertilizers were applied as per recommended schedule for *Aonla* plantation. In all 8 treatments viz., to control (water-spray), T₁-K₂SO₄ (2% spray), T₂-KCL (2% spray), T₃-KNO₃ (2% spray), T₄-K₂SO₄ (2%) + urea (2%), T₅-KCL (2%) + urea (2%), T₆-KNO₃ (2%) + urea (2%), spray and T₇-urea (2% spray) were tested in complete randomized block design using 3 replications. The foliar spray of nutrients as per treatment was applied twice after fruit set.

First spray was done during second week of April, 2013 and second spray was followed during third week of June, 2013 at the time of fruit bud development stage. Spraying of material was done using as pee pneumatic foot sprayer fitted with nozzle. In each spraying, 10 litre solute material per tree as per treatment was used. The observations on each tree were recorded for fruiting behaviour, fruit size, fruit weight, pulp: stone ratio and fruit yield per tree. Sampled fruits from each tree were analyzed chemically for recording their quality in terms of Total soluble solids, acidity, Ascorbic acid (Vitamin 'C'), reducing, non-reducing and total sugar. Whole data were analysed character wise by using standard statistical method suggested by Panse and Sukhatme (1985).

Results and Discussion

The data presented in Table 1 revealed that foliar application of nutrients reduced fruit drop and increased fruit retention as compared to control but significance of treatments varied. Dual spray of potassium + urea in all cases reduced fruit drop significantly compared to control but single spray of only potassium irrespective of source or urea *Alone* could not reduce fruit drop significantly as compared to control. In case of fruit retention, all treatments of nutrients spray except KNO₃ (2%), increased fruit retention significantly over control.

Among those, K₂SO₄ + urea spray being at par with KCL + urea spray, recorded significantly higher fruit retention than all other treatments. It is thus proved from these results that the treatment of K₂SO₄ + urea spray was most effective in minimizing the fruit drop and in maximizing the fruit retention among all treatments tasted. It was followed by the treatment of KCL + urea spray in fruit drop and retention.

The best performance of K₂SO₄ + urea spray might be the combined beneficial effect of potassium, sulphur and nitrogen on fruit retention. These results are in accordance to the findings of Khan *et al.*, (2009).

Physical characters of fruits

Foliar application of only potassium sources though improved fruit characters over control but margin of increase was not found significant in any case (Table-1). The combined spray of potassium + urea irrespective of sources being at par improved almost all physical characters of fruit significantly over control and also over other treatments. Fruit weight which is the resultant of overall fruit development was recorded highest of 35.40 g under K₂SO₄ + urea spray followed by 35.10 g under KCL + urea spray

treatment. These figures were found to be 4.58, 5.51, 6.63, 6.63, 8.76, 8.76 and 12.03% higher; and 3.69, 4.62, 5.72, 5.72, 7.83 and 11.08% higher over fruit weights recorded under KNO₃ + urea, urea alone, K₂SO₄ alone, KCL alone, KNO₃ alone spray and control, respectively. Pulp: stone ratio also showed almost similar trend under different treatments. Better

performance of K₂SO₄ + urea and KCL + urea spray treatments might be due to supply of sulphur, chlorine and nitrogen along with potassium. These nutrients together might have played important beneficial role in proper development of *Aonla* fruits. These results corroborate to the findings reported by Singh *et al.*, (2009).

Table.1 Effect of different sources of potassium without and with urea on physical characters of *Aonla* fruits

| Treatments | Fruit drop (%) | Fruit retention (%) | Fruit length (cm) | Fruit width (cm) | Fruit weight (g) | Pulp weight (g) | Stone weight (g) | Pulp stone ratio |
|---|----------------|---------------------|-------------------|------------------|------------------|-----------------|------------------|------------------|
| Control (water spray) | 82.4 | 17.60 | 2.75 | 3.10 | 31.60 | 28.70 | 2.90 | 9.90 |
| K ₂ SO ₄ (2% spray) | 79.0 | 21.00 | 2.85 | 3.25 | 33.20 | 30.36 | 2.84 | 10.69 |
| KCL (2% spray) | 77.8 | 22.20 | 2.90 | 3.33 | 33.20 | 30.45 | 2.75 | 11.07 |
| KNO ₃ (2% spray) | 79.7 | 20.30 | 2.80 | 3.22 | 32.55 | 29.70 | 2.85 | 10.42 |
| K ₂ SO ₄ (2%) + urea (2%) | 70.8 | 29.20 | 3.40 | 3.90 | 35.40 | 32.93 | 2.47 | 13.33 |
| KCL (2%) + urea (2%) | 72.7 | 27.30 | 3.30 | 3.80 | 35.10 | 32.47 | 2.63 | 12.35 |
| KNO ₃ (2%) + urea (2%) | 74.9 | 25.10 | 3.25 | 3.74 | 33.85 | 31.15 | 2.70 | 11.54 |
| Urea (2% spray) | 76.0 | 24.00 | 3.00 | 3.45 | 33.55 | 30.80 | 2.75 | 11.20 |
| S. Em. ± | 2.14 | 1.09 | 0.07 | 0.08 | 0.65 | 0.79 | 0.06 | 0.31 |
| C.D. (P= 0.05) | 6.49 | 3.32 | 0.22 | 0.24 | 1.96 | 2.41 | 0.18 | 0.94 |

Table.2 Effect of different sources of potassium without and with urea on quality parameters of *Aonla* fruits

| Treatments | Total soluble solids (%) | Acidity (%) | Red. Sugars (%) | Non-red. Sugars (%) | Total sugar (cm) | Ascorbic acid (mg/100 g pulp) | Fruit yield (kg/tree) | Increased yield over control | |
|---|--------------------------|-------------|-----------------|---------------------|------------------|-------------------------------|-----------------------|------------------------------|-------|
| | | | | | | | | (kg) | (%) |
| Control (water spray) | 8.55 | 2.42 | 2.37 | 1.85 | 4.22 | 525.10 | 76.80 | - | - |
| K ₂ SO ₄ (2% spray) | 8.98 | 2.38 | 2.50 | 2.14 | 4.64 | 538.75 | 84.40 | 7.60 | 9.90 |
| KCL (2% spray) | 8.98 | 2.37 | 2.50 | 2.14 | 4.64 | 538.75 | 84.40 | 7.60 | 9.90 |
| KNO ₃ (2% spray) | 8.88 | 2.35 | 2.44 | 2.10 | 4.54 | 534.45 | 81.85 | 5.05 | 6.58 |
| K ₂ SO ₄ (2%) + urea (2%) | 9.40 | 2.22 | 2.73 | 2.24 | 4.97 | 559.15 | 111.09 | 34.29 | 44.65 |
| KCL (2%) + urea (2%) | 9.30 | 2.27 | 2.67 | 2.17 | 4.84 | 550.40 | 94.05 | 17.25 | 22.46 |
| KNO ₃ (2%) + urea (2%) | 9.15 | 2.32 | 2.60 | 2.15 | 4.75 | 543.30 | 91.60 | 14.80 | 19.27 |
| Urea (2% spray) | 9.10 | 2.34 | 2.58 | 2.14 | 4.72 | 541.30 | 90.60 | 13.80 | 17.97 |
| S. Em. ± | 0.15 | 0.03 | 0.03 | 0.02 | 0.06 | 4.48 | 3.77 | - | - |
| C.D. (P= 0.05) | 0.44 | 0.09 | 0.10 | 0.07 | 0.19 | 13.58 | 11.43 | - | - |

Fruit quality

The data furnished in Table-2 revealed that application of K₂SO₄, KCL or KNO₃ could not affect the total soluble solids (TSS) or fruit

acidity significantly when compared to control. These nutrients when sprayed with urea increased TSS and decreased fruit acidity significantly as compared to control treatment.

It might be attributed to combined effect of sulphur, chlorine and nitrogen along with potassium on accumulation of higher level of water soluble compounds viz. total sugars, vitamins, and minerals which were synthesized, translocated and accumulated during fruit development and maturity stages because of certain chemical changes. Singh *et al.*, (2009) also reported almost similar results. All treatments of nutrients spray significantly increased the percentage of reducing non-reducing and total sugars over control treatment. Among nutrients spray treatments, combined spray of K_2SO_4 + urea being at par with KCL + urea spray recorded significantly higher percentage of sugars than remaining all treatments. The reason may be explained due to the role of potassium in CHO synthesis, breakdown and translocation and synthesis of protein and neutralization of physiologically important organic acids. Ascorbic acid content in fruit increased significantly due to foliar spray of nutrients in all cases over control. Among those, K_2SO_4 + urea being at par with KCL + urea spray, recorded significantly higher level of ascorbic acid content in fruits than all other treatments. It might be the balanced foliar nutrition of potassium, sulphur, chlorine and nitrogen which perhaps improved the ascorbic acid content of fruits. It may be supported by the findings of Ali *et al.*, (1993).

Fruit yield

It is visible from Table-2 that the treatments of foliar spray of nutrients increased fruit yield per tree over control, but the foliar spray of only potassium sources could not record margin of yield increase to be significant. The combined spray of K_2SO_4 + urea recorded significantly highest of 111.09 kg/tree fruit yield which

might be attributed to fruit retention per cent and weight of individual fruit. Combined spray of KCL + urea or KNO_3 +urea or urea alone being at par yielded significantly higher fruit over control only.

The best treatment of, K_2SO_4 + urea spray recorded 34.29 kg/Tree or 44.65% higher fruit yield increase over control treatment of water spray. The best performance of K_2SO_4 + urea spray may be explained due to supplemental nutrition of potassium, sulphur and nitrogen through foliar application of nutrients which might has helped in increasing percentage of fruit retention and in proper development of individual fruit. These results are in conformity to the findings of Singh *et al.*, (2009).

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