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Impact of KNO₃ on major fruit crops

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Abstract

Fruit growing is an indigenous practice for human being. It is developed and still developing culture for growers. KNO₃ applied by aerial spray to the fruit crops improves yield, yield attributing characters and quality parameters. In Mango, the application of KNO₃ is effective twice at 1st flower bud differentiation followed by another spray during the full bloom stage with concentration of 1% for flowering, fruiting, yield and quality characteristics. KNO₃ spray at last week of October and November at 1.5% increase quality parameters of Ber. In Banana, KNO₃ two sprays, 1st spray after complete emergence of bunch and 2nd after 15 days after first spray with 1.5% increase organoleptic parameters. In Sapota, two application of KNO₃ 2%, 1st spray at November and 2nd two months after 1st spraying increased fruit retention, yield and physical parameters. KNO₃ 1.5% twice (1st spray before flowering and 2nd at fruit set) increase fruit yield and quality characters of Custard apple, while in Guava KNO₃ spraying done before flowering, at flowering and after flowering at 15 days interval with 1.5% increase no. of flowers and fruit retention. Citrus responded well to girdling + 2% KNO₃ 1st at beginning of April and 2nd at mid-June and KNO₃ 2% increased juice content. In Pomegranate, KNO₃ and K₂SO₄ twice at last week of April and May increased average fruit weight, yield and TSS. Though, the response of KNO₃ was noted different in various varieties of pomegranate. In Papaya, KNO₃ 2% gave a maximum germination percentage.

Keywords: fruit crops, KNO₃, flowering, retention, quality, organoleptic

Introduction

Fruits are of utmost importance now a day in the day to day life of any human being. In fruit crops late flowering, broader flowering span, poor fruit set, poor fruit retention and inferior quality is a major problem for fruit growers. To overcome these problems improvement in agronomical practices, selection of proper variety and use of some chemicals can be pragmatic.

Potassium nitrate improves tolerance towards frost, increase the resistance of the plant towards diseases, enhances drought tolerance, combats salinity, improves the water use efficiency of crops and saves water, potassium in potassium nitrate prevents water losses, improves soil properties, enhances availability of phosphorous and micronutrients, easy to handle and to apply, compatible with other fertilizers. Both N and K are required by plants to support harvest quality, protein formation, diseases resistance and water-use efficiency. Therefore, to support healthy growth, farmers often apply KNO₃ during the growing season. KNO₃ primarily used where its unique composition and properties can provide specific benefits to growers. Further, it's easy to handle and apply and is compatible with many other fertilizers, including specialty fertilizers for many high value specialty crops, as well as those used on grain and fiber crops. Nitrate is Non-volatile, so there is no need to incorporate it in the soil when applied by top- or side dressing, which makes it a convenient source for application. Nitrate can be readily absorbed by the plant and do not need to undergo any further conversion as is the case with urea and ammonium, before plant uptake. No acidification of the soil if the entire nitrate is applied as nitrate-nitrogen. Nitrate limits the uptake of harmful elements, such as chloride, into large quantities. Trewavas (1983) [21] noted that KNO₃ could be used to break dormancy of buds, particularly flower buds, which is one of the direct effects of nitrate. Tree need to have adequate nitrogen reserves for flowering and subsequent fruit formation. Valmayor (1962) [22] studied that spraying with KNO₃ increase internal ethylene concentrations of shoots and ethylene forming enzyme (EFE) activity in leaves that's initiation of flowering. Protacio (2000) [14] hypothesized that, once gibberellins levels fall below a threshold level, starch can start to accumulate, allowing the tree to flower. After sufficient starch has accumulated, floral initiation will ensue. However, the buds will remain quiescent until conditions are favourable for flowering. KNO₃ may active those quiescent buds for floral initiation.

Mango

Amarcholi *et al.* (2016)^[11] investigated to know the influence of chemicals on flowering characteristics of 'Kesar' mango and found that foliar application of KNO₃ 1% twice flower bud differentiation and during fullbloom stage gave maximum flowering percentage (26.12 %), fruit set percentage (0.21 %), fruit retention (20.45 %), no. of fruits/panicles (2.10), no. of fruits/tree (276.33) and fruit yield (11.30 t/ha). Chaudhari (2016)^[41] studied that paclobutrazol 2.50 g + KNO₃ 1% gave a maximum no. of fruit set at pea stage/panicle (20.83), no. of fruit set at marble stage/panicle (4.93), no. of fruit harvest/panicle (1.46), no. of fruits/tree (132.50) and yield (t/ha) (18.97) of mango cv. Sonpari. (KNO₃ @ 1% spray done at first fortnight of October). Muhammad *et al.* (2007)^[9] studied that KNO₃ spray at last week of January before blooming result indicated that KNO₃ 3% were found favorable to induce early emergence of panicles, increase panicle length (38.77), percentage of hermaphrodite flowers (34.39%) and fruit set (14.06) in mango. Vijayalakshmi (1997)^[25] observed that with application of KNO₃ increased in specific leaf area, chlorophyll content, stomata conductance, net photosynthesis, leaf nitrogen percentage and soluble protein content in mango. And KNO₃ 1% favoured for higher activities of enzymes such as catalase (CAT), peroxidase (POX) and NRase aiding in abiotic stress tolerance and enhanced fruit yield in mango.

Gupta and Brahmachari (2004)^[5] indicated that mango fruits cv. Bombai recorded maximum weight and yield/tree sprayed with KNO₃ 4%. Kumar *et al.* (2004) potassium nitrate showed significant effect on flowering, sex expression and yield of mango. That minimum day required for panicle emergence (148.92) and flowering (3.08), maximum no. of hermaphrodite flowers (5.99) and maximum no. of fruits per panicle (2.40). Burondkar (2005) observed that KNO₃ 1% maximum with reducing sugar (7.45%), total sugar (16.58%) and colour (8.50) in mango cv. Alphonso. (KNO₃ 1% foliar spray at full bloom, marble and egg stages). Patolia *et al.* (2017)^[13] reported that KNO₃ 2% sprayed twice, first fortnight of October and then November gave maximum number of fruits/tree (191.34), maximum fruit weight (170.19 g), higher yield (32.49 kg/tree), maximum TSS (19.79 °B), maximum total sugar (13.70%), non reducing sugar (3.27%), reducing sugar (10.50%) and fruit firmness (4.17 kg/cm²) in Dashehari mango.

Sudha *et al.* (2012)^[18] reported that KNO₃ 2 per cent twice spray at fifteen-days intervals from 15th November to 30th December obtained maximum number of flowering shoots (68.7 %), number of panicles (7.5/m²), panicle length (31.4 cm), number of hermaphrodite flowers (282.5/panicle), maximum fruit set (17.0 %), number of fruits (146.0/tree), fruit yield (43.8 kg/tree), chlorophyll content (1.7 mg/g) and carbohydrate (14.5g/100g) in mango cv. Alphonso. Babul and Rahim 2013^[2] studied the effect of foliar spray of KNO₃ 4 per cent sprayed at 15 November gave superior results with respect to length of panicle (38.83), width of panicle (31.87), no. of secondary branches per panicle (43.03), no. of fruits per plants (136.67), vita. C (32.23 mg/100g pulp) and shelf life (10.33 days) as compared to other treatment in mango.

Ber

Gill and Bal (2009)^[5] reported that KNO₃ 1.5% spray last week of October and November increase fruit length (4.71 cm), fruit breadth (3.09cm), fruit weight (24.0 g), palatability rating (16.5) and TSS (16.9°B) in ber cv. Sanaur-2. Yadav

(2014)^[26] Studied that KNO₃ 2% spray three different interval at 1st November, 2nd January and 3rd February gave highest specific gravity percent (1.083 %), TSS (16.5 °B), Ascorbic acid (127.48 mg/100g of pulp) in ber cv. Banarasi Karaka.

Banana

Yelve (2008)^[27] indicate that KNO₃ 1.5% minimum days for harvesting (95 days) and highest bunch weight (27.83 kg/plant), no. of fruits/bunch (142.67) and also increase the shelf life (9.50 days) in banana as compared to other treatments. Swati *et al.* (2017)^[19] observed that in banana cv. Grand Naine KNO₃ 1% 1st spray after complete emergence of bunch and 2nd after 15 days of first spray increased in organoleptic parameters like colour (8.06), flavor (8.05), test (8.07) and textur (8.09).

Sapota

Sharma *et al.* (2016)^[17] studied that KNO₃ 2% 1st spray at November and 2nd two month after 1st spraying gave maximum fruit retention percentage (25.02%), no. of fruits per tree (406.67), yield (46.28 kg/ha), fruit weight (106.84 g), Pulp weight (96.62 g), fruit length (62.64 mm), fruit breadth (62.92 mm) and fruit volume (102.56 cc) in sapota.

Custard apple

Ramesh (2015)^[15] Studied that KNO₃ 1.5% 1st spray before flowering and 2nd at fruit set with maximum no. of fruits per plant (29.83), highest fruit length and fruit breadth (10.45 cm and 12.35 cm) respectively, maximum average fruit weight (264.72 g), fruit yield (7.19 kg/ha), minimum Rind (%/fruit), Seed (%/fruit) and Seed no./fruit and also obtained maximum pulp percent per fruit (40.1%) in custard apple cv. Balanagar.

Guava

Manju (2016)^[8] reported that KNO₃ 3% single spray at 24 July along with 1 pair leaf pruning observed highest no. of flowers (8.71), minimum days to opening of flowers (33.03), highest fruit set (97.29 %) yield (8.74 kg/plant), highest fruit weight (180.18 g) and maximum fruit length (6.87 cm) in guava cv. Alahabad safeda. Sanjay (2015) evaluated that no. of flowers/shoot (22.70) and fruit retention/shoot (6.82) highest with application of KNO₃ 1.5% Spraying before flowering, at flowering and after flowering at 15 days interval in guava cv. L-49.

Pomegranate

Thirupathi and Ghosh (2015)^[20] observed that spraying of KNO₃ and K₂SO₄ interaction with different varieties of pomegranate in Bassein seedless increased no. of fruits/plant (43.66), maximum total juice content (54.126 %), highest yield (9.08 kg/plant) and Jyothi observed highest average fruit weight fruit (255 g).

Citrus

Vijay *et al.* (2016)^[24] studied that KNO₃ 2% found maximum juice content (34.42 %) and KNO₃ 4% along with two sprays in the last week of April and August obtained highest yield (76.90 kg/plant) in sweet orange cv. Jaffa. Mostafa and Saleh (2006)^[10] observed that girdling + 2% KNO₃ two spray 1st at beginning of April and 2nd at mid June gave maximum yield/tree (65.0kg), number of fruits per tree (412), maximum total carbohydrate content (12.36 %) and total chlorophyll content (384) in Balady mandarin.

Papaya

Padma *et al.* (2013)^[11] found that KNO₃ 2% along with 24 hr duration gave maximum germination per cent (91 %) in papaya seed. Veerannah and Selvaraj (1984)^[23] studied that uptake of K at different stages in papaya (CO-1) of growth including flowering fruiting and harvesting the need was found different but at harvesting and fruit development stage its requirement is higher.

Conclusion

KNO₃ applied by aerial spray to the fruit crops improves yield, yield attributing characters and quality parameters. In fruit crops like mango, ber, banana, Sapota, custard apple, guava, citrus, pomegranate and papaya, the application of KNO₃ is effective for early germination, flowering, fruit retention, yield and yield attributing characters. KNO₃ also improves quality characteristic and organoleptic parameters of all the fruits.

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