

Study on Physiochemical Properties of Fruits as Influenced by Naphthalene Acetic Acid: A Review

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Abstract- Naphthalene acetic acid has various physiological roles viz., encouraging cell division and enlargement of cells. Naphthalene acetic acid can enter into plant by various means like through leaves, branches and tender skin etc. and can influence plant and fruit properties. Naphthalene acetic acid increases the growth rate of fruit which results into a bigger size at harvest without any undesirable reduction in yield and will eventually enhance the quality of the fruit. Naphthalene acetic acid is toxic to plants at high concentrations. Increased amounts of Naphthalene acetic acid has undesirable effects and cause growth embarrassment. High concentrations can check the rate of many metabolic reactions.

Keywords: Fruits, NAA, Physio-Chemical Characters, Post-Harvest life, Quality

1. INTRODUCTION

PGR have been proved useful in agriculture particularly in horticulture. Various techniques are used to enhance crop quality and shelf life. The most important of role of NAA for improving the post-harvest life of produce, cannot be denied. A large amount of fresh fruits are spoiled worldwide after harvest [1]. The main reasons are related to shelf life or physiological pathological and physical. These causes, in most occurrences can be interconnected, that is, mechanical damage can lead to post-harvest degeneration in most cases [2]. Damages are assessed as 20-40% in developing countries and 10-15% in developed countries, depending on the crop and the season [3-4]. The production of inferior quality fruits is a problem of common experience. The effect of NAA on plant growth is dependent on the time of application and concentration. The consumption tendency of fresh tropical fruits and their products is increasing gradually due to consumer's education on their stimulating flavors, nutritive value and phytochemical properties with favorable health effects. The post-harvest losses ranges from 20-30 per cent [1] reason being the gentle nature of the fruit and poor storage facilities. Improvement in control of ripening process is of fundamental importance for growth of a wide-ranging fruit industry. A lot of work has been done by various workers regarding the effects of NAA on different aspects of different fruits. In this review, we focus on the functions of NAA in improving the physio-chemical characters of various fruits.

I. EFFECT OF NAA ON FRUIT SIZE

Yeshayahu et. al. [5] specified that spray of NAA increased size of the fruit in 'Myovaze Satsuma' mandarin. Highest yield with largest fruit sizes of ber fruits in cv. Umran were obtained [6]. It was established that fruit size and weight were increased by NAA [7]. Treatment with 20 ppm NAA treatment in 'Priana' and 'Beliana' obtained good fruit size in apricot cultivars [8]. It was determined in guava that plant growth regulators significantly increased the fruit length and diameter [9]. Melissa et. al. [10] observed that fruit length of plants treated with NAA got decreased. NAA also produced lesser amount of seeds and gave fruits with improved weight [11-12]. Stern et. al. [13] revealed that NAA caused an appreciable improvement in fruit size. Ansari et. al. [14] described that NAA spray improved the size of fruit of Nagpur mandarin regarding fruit length and breadth. It was established that application of NAA is helpful in improving fruit size in pomegranate cv. Ganesh [15]. There was recorded improvement in fruit length and breadth with the application of NAA in case ber cv. Umran [16]. It was observed that fruit diameter and yield per plant was found maximum in the treatment of NAA+Ethrel [17]. It was discovered NAA showed maximum fruit volume and early maturity in local Malta [18].

II. EFFECT OF NAA ON FRUIT WEIGHT

Van et. al. [19] established that NAA treatment had improved fruit weight and TSS in dragon fruit. Application of NAA in winter season Guava cv. L-49 increases the fruit weight investigated by Yadav et. al. [20]. Maximum fruit weight was detailed with NAA as indicated by Ram Asrey et. al. [21]. Al-Juburi et. al. [22] discovered that NAA increased fruit weight per bunch and per tree. Ingle et. al. [23] discovered that foliar spray of NAA improved fruit weight in Nagpur mandarin. Marbhal et. al. [24] conferred that application of NAA showed increase in fruit weight by 34%. Ravi Kher et. al. [25] studied the effect of NAA on physico-chemical features of guava and determined that fruit weight was improved with higher concentrations of NAA. It was recorded advanced fruit size in terms of length and breadth and weight with application of NAA [26]. It was verified that in plum cv. Satluj purple

fruit characters like fruit weight and total soluble solids were improved with NAA treatment [27]. It was revealed that NAA increases fruit size and total yield but had unfavorable effects on fruit quality at maturity and during storage [13]. It has been deliberated that naphthalene acetic acid treatments improved bunch weight along with other physical properties of fruit [28]. It was found that fruit weights were higher in case of apples trees when NAA treatment was applied [29]. Ansari et. al. [14] stated that NAA sprayed during fruit set results in increased fruit weight of Nagpur mandarin. Kassem et. al. [30] established that NAA increased fruit weight and TSS. Singh et. al. [31] found in 'Dashehari' mango that treatments with NAA resulted in least decrease in fruit weight. Kacha et. al. [32] revealed that NAA resulted in increase in fruit weight phalsa under South-Saurashtra conditions. Garasiya et. al. [33] studied that application of NAA increased fruit weight. Safaei-Nejad et. al. [34] showed that application of NAA resulted in improvement of weight. Ghosh et. al. [35] noted that in pomegranate fruit weight was improved with application of NAA.

III. EFFECT OF NAA ON FRUIT COLOUR

Yadav et. al. [20] concluded that organoleptic rating of the guava fruit can be greatly improved by application of NAA. Amorós et. al. [36] applied NAA in loquat fruit and established that NAA treatment did not influenced fruit colour. Rizk-Alla et. al. [37] discovered that NAA treatment had increased berry colour and declined acidity. NAA increased skin colour (Hunter 'L', 'a' and 'b') gradually in guavas. Mature green stage fruits showed encouraging results in suspending the physiological and biochemical changes related with colour turning stage as mentioned by Phani et. al. [38].

IV. EFFECT OF NAA ON FRUIT FIRMNESS

Niranjala et. al. [39] found higher firmness in bananas cured with NAA. He established that NAA application delayed the loss of firmness. Stover et. al. [40] established in apples that NAA influences the firmness of the fruit. Amorós et. al. [36] applied NAA at 30% of final fruit size of loquat fruit and established that NAA treatment had no influence towards firmness. It has been revealed in apples that NAA improved fruit ripening as determined by fruit firmness [41]. Mandal et. al. [42] recorded better firmness in guava fruits with treatment of NAA. Figueroa et. al. [43] found that NAA decreased the transcript level of cell wall degrading genes after cold storage, although no differences in firmness were observed in strawberry. Auxin could individually alter fruit ripening preventing the normal degradation of cell wall during cold storage. NAA reduce the transcript level of important cell wall degrading genes after cold storage, although there were no differences in firmness.

V. EFFECT ON NAA ON PHYSIOLOGICAL LOSS IN WEIGHT (PLW)-

Ladaniya et. al. [44] recorded advanced loss in weight in different fruits of subsequent storage. It has been stated that guava remained in good state for up to 3.6 weeks at 10°C and fruits treated with NAA showed the

lowest spoilage [45]. Analogous findings are given in guava [46] and Martinsson et. al. [47] in strawberry. Dikki et. al. [48] specified that NAA treatment caused better retaining of physiological loss in weight in papaya. Mandal et. al. [42] discovered that the PLW improved with NAA throughout storage period. Meena et. al. [49] found that NAA was effective in reducing the fruit weight and decay loss. Brackmann et. al. [50] established that fruits treated with amino vinyl glycine in the field showed an opposite response to the fruits with NAA in apple.

VI. EFFECT OF NAA ON SPOILAGE PERCENTAGE-

Fruits preserved with NAA recorded lower spoilage during cold storage might be due to delay in senescence and low temperature inside the cold storage. It was discovered that treatment with NAA prolongs shelf-life and shortened spoilage and enhanced fruit quality by delaying the onset of senescence [46]. Olaiya et. al. [51] proved that NAA treated tomato has better storage features, based on spoilage loss. Rizk-Alla et.al. [37] proved that NAA was the best treatment for reduced wastage, resultant either from disease infection or physiological maladies and repressed the rate of decline of physical and chemical properties of grapes during cold storage by reducing weight loss, decay and total spoilage. Mandal et. al. [42] concluded NAA treatment had better prospective for preserving fruit quality of the guava fruits.

VII. EFFECT OF NAA ON TOTAL SOLUBLE SOLIDS

Rise in TSS during storage may probably be due to hydrolysis of insoluble polysaccharides into simple sugars. Van et. al. [19] found in dragon fruit that NAA augmented TSS. Yadav et, al. [20] concluded that TSS content of guava fruits can be improved with application of NAA. Sawale et. al. [52] found good quality fruits with respect to TSS after treatment with NAA. Similar work has been reported in Arkavati grapes that NAA influenced TSS [53]. Highest soluble solids (TSS) with NAA in 'Priana' table apricot were obtained in Turkey [8]. Katiyar et. al. [54] proved that NAA resulted in maximum TSS content. Iqbal et. al. [55] established that fruit TSS was greatly influenced with NAA application. Ghosh et. al. [35] observed highest TSS in pomegranate with NAA. Milić et. al. [56] found that NAA proved to be influential in augmentation of fruit weight in apples. Abbasi et. al. [57] showed that tomato fruits maintained the best quality with NAA. Safaei et. al. [34] showed that the treatment of NAA improved fruit TSS and weight. NAA improved fruit size. Khandaker et. al. [58] described that total soluble solids of apple fruits were improved after NAA treatment. Palei et.al. [59] discovered in strawberry that yield endorsing physical and chemical characteristics were found improved with NAA.

VIII. EFFECT OF NAA ON VITAMIN C (MG/100G FRESH WEIGHT)

Sawale et. al. [52] revealed that with application of NAA fruit were rich in vitamin c. It has been observed that ascorbic acid content can be improved by application of NAA [6]. Sharma et. al. [60] discovered that ascorbic acid content of litchi fruit could be increased with

application of NAA. Singh et. al. [61] advocated that NAA treatment produced guava fruits with higher ascorbic acid. It was suggested that NAA proved to be effective in improving the quality of apple [62]. Kassem et. al. [30] disclosed that fruit physical characteristics were modified by NAA in date palm. Ahmed et. al. [63] revealed that ascorbic acid content was higher after NAA treatment. Osama et. al. [64] found that NAA enhances chemical and physical traits of the fruit. Abdel-Sattar et. al. [65] found that NAA causes good increase in fruit quality characteristics of plum. Parkhe et. al. [66] discovered that NAA application improved yield and quality of guava fruit.

IX. EFFECT OF NAA ON ACIDITY-

Sawale et, al. [52] established that appropriate acidity can be obtained with NAA treatment. Ingle et. al. [23] established that spray of NAA enhanced acidity and total yield in mandarin. It has been discovered that NAA treatment decreased the acidity in Umran ber [6]. Pawar et, al. [67] described that acidity was lowered in pomegranate cv. Mridula after treatment with NAA. It has been revealed that there was reduction of titrable acidity under NAA [12]. Analogous findings have been affirmed by [46] and Killadi et. al. [68] in guava fruits. Iqbal et. al. [55] recorded that NAA application improved all important ingredients except acidity which was decreased. At higher concentrations fruit quality was inferior. Mandal et. al. [42] experienced a declining tendency in titrable acidity with the progression of storage period. The fruits treated with higher concentration of NAA retained higher acidity during storage. Desai et. al. [69] observed in tomato that the highest acidity could be obtained with NAA. Khunte et. al. [70] recorded minimum titrable acidity in plants treated with NAA. Ibrahim et. al. [71] established that application of NAA caused extension of storage life, decrease in weight loss and quality features of mango. Safaei-Nejad et. al. [34] established that fruit qualities such as TA and ascorbic acid were not affected by the application of NAA.

X. EFFECT OF NAA ON TOTAL SUGARS-

Rise in total sugars during storage may possibly due to hydrolysis of insoluble polysaccharides into sugars. It was established that NAA treatment in mandarin advanced reducing and non-reducing sugars [72]. Highest total sugar content was obtained in mango fruit with application of NAA [73]. Total sugars had shown increasing trend during storage. Haidry et. al. [74] discovered that application of NAA in mango cv. Langra resulted in increase of sugars. Yadav et. al. [20] specified that improvement in TSS with NAA in winter season guava cv. L-49. NAA exhibited increased sugar content and the highest ascorbic acid content with NAA application. Amorós et. al. [36] recorded that NAA was helpful in improving fruit quality in terms total sugars and reducing sugar [7]. Son et. al. [8] observed that NAA treatment in apricot had increased total soluble solids. Singh et. al. [61] and Nawaz et. al. [75] explored maximum total sugar contents in NAA treated fruits. Khunte et. al. [70] established that total sugar of strawberry fruits treated with NAA were higher. Kirmani et. al. [77] showed in plum that

application of NAA caused decrease in total sugars. Application of NAA caused increase in total sugars. [76]

2. CONCLUSION

NAA at low concentrations can stimulate plant growth, prevent flower drop and so on; while high concentration can inhibit plant growth. It also results in wilting and the effect lasts longer, the harm to fruit plant will be greater, more likely to cause flower drop. Therefore, its concentration (to be used) is very important. NAA treatment results in increase in size of the fruit which ultimately reflects increase in yield along with significant increase quality of fruit.

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