Effect of foliar application of salicylic acid and prohexadione-calcium on leaf nutrient content of apple cv. Red Delicious

Original Research Article

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ABSTRACT

Present experiment entitled "Effect of foliar application of salicylic acid and prohexadione-calcium on leaf nutrient content of apple cv. Red Delicious" was conducted at private orchard Nikas, Pulwama during 2014 and 2015. The experiment comprising of 10 treatments *viz*., control, salicylic acid (SA) @ 50 ppm, 100 ppm, 150 ppm and 200 ppm, prohexadione-calcium @ 600 ppm, SA @ 50 ppm + prohexadione-calcium @ 600 ppm, SA @ 100 ppm + prohexadione-calcium @ 600 ppm, SA @ 150 ppm + prohexadione-calcium @ 600 ppm and SA @ 200 ppm + prohexadione-calcium @ 600 ppm was laid out in Randomized Complete Block Design with three replications. The results revealed that leaf nutrient content was significantly affected by treatments during both the years. Highest leaf N (2.58 and 2.70 %), P (0.33 and 0.38 %), K (2.07 and 2.13 %) and Ca (2.20 and 2.23 %) content was recorded in trees sprayed with SA @ 150 ppm + prohexadione-calcium @ 600 ppm and lowest leaf N (2.01 and 1.98 %), P (0.12 and 0.16 %), K (1.75 and 1.78 %) and Ca (1.57 and 1.62 %) content was recorded in trees receiving no treatment. Thus it may be concluded from the present investigation that combined spray of salicylic acid and prohexadione-calcium proved beneficial in improving the nutrient content of apple trees.

Keywords :

Apple, foliar spray, leaf nutrient content, prohexadione-calcium, salicylic acid.

I. INTRODUCTION

Optimum concentration of leaf nutrient content i.e Nitrogen, phosphorous, potassium and calcium are very important for improving growth, yield, quality and storability of fruits. Plant growth regulators, both natural and synthetic, are commonly known to modify plant growth and influence the production of metabolites and byproducts. Various plant bioregulators are being used in different fruit trees for increasing uptake of nutrients thereby leading to improvement in growth, flowering, fruit quality, storability and yield. However recently new plant growth regulators like salicylic acid and prohexadione-calcium have been found beneficial in maintaining balance between vegetative and reproductive growth, increasing the uptake of nutrients by plants etc thereby resulting in high yield of superior quality fruits with prolonged storability and consistent bearing. Salicylic acid is one of the groups of common phenolic compounds that are produced naturally by plants, which can act as endogenous plant growth regulator (Aberg, 1981). The chemical structure of SA is composed of an aromatic ring bearing a hydroxyl group and it deduced as 2-hydroxy benzoic acid. In addition, SA could be classified as phytohormones. Salicylic acid is a phenolic derivative, distributed in a wide range of plant species. It is a natural product of phenylpropanoid metabolism. It appears to be just like in mammals an effective therapeutic agent for plants. Besides this function during biotic and abiotic stress plays a crucial role in the regulation of physiological and bio-chemical processes during the entire lifespan of plant. Its application might be safe and more useful for plant growth improving. Salicylic acid stimulates the growth and development of shoots and roots of the treated plants thereby improving nutrient uptake. It is ubiquitous in plants generating a significant impact, transpiration, ion uptake and transport. Enhancement of the level of chlorophyll and carotenoid pigments, photosynthetic rate and modifying the activity of some of the important enzymes are other roles assigned to salicylic acid. It induces specific changes in leaf anatomy and chloroplast structure. Another chemical prohexadione-calcium also plays an important role in regulating various physiological processes of apple trees. Prohexadione-calcium, which was registered in Spain in 2002 is also a GA-biosynthesis inhibitor and has the property of reducing growth. Prohexadione-calcium reduces GA_1 levels and increases the concentration of its precursor, GA_{20}. In fact, to be precise it blocks two oxoglutarate dependent dioxygenases that inhibit the hydroxylation of GA_{20} into GA_1. One of the most interesting characteristics of prohexadione-calcium is its rapid metabolic catabolism (Evans *et al.,* 1997) and its low toxicity and limited persistence, which also indicate that it poses no apparent risk to either the consumer or the environment. Besides this prohexadione-calcium also plays an important role in increasing uptake of nutrients by increasing root growth at the cost of shoot growth. Keeping in view the importance of salicylic acid and prohexadione-calcium in regulating growth of apple the present investigation was carried out to study the effect of foliar application of salicylic acid and prohexadione-calcium on leaf nutrient content of apple cv. Red Delicious.

II. MATERIALS AND METHODS

The present investigation on "Effect of foliar application of salicylic acid and prohexadione-calcium on leaf nutrient content of apple (*Malus × domestica* Borkh) cv. Red Delicious" was carried out at Pulwama (Jammu & Kashmir) in a private orchard during 2014 and 2015. The selected trees of uniform vigour and age were grafted on seedling rootstock. The experiment comprising of 10 treatments *viz.*, control, salicylic acid (SA) @ 50 ppm, 100 ppm, 150 ppm and 200 ppm, prohexadione-calcium @ 600 ppm, SA @ 50 ppm + prohexadione-calcium @ 600 ppm, SA @ 100 ppm + prohexadione-calcium @ 600 ppm, SA @ 150 ppm + prohexadione - calcium @ 600 ppm and SA @ 200 ppm + prohexadione-calcium @ 600 ppm was laid out in Randomized Complete Block Design with three replications. The chemicals sprays were applied at petal fall stage, fruit development stage-I and fruit development stage-II. Observation on leaf nutrient content was recorded from fully mature leaves which were taken from middle shoots of current season growth. Leaf samples were collected as per the procedure described by Chapman (1964) from each replicate and analyzed for their nutrient content. Nitrogen was estimated by Micro-Kjeldahl's method. Phosphorous was estimated by Vanado molybdo-phosphoric yellow colour method. Potassium was estimated by Flame Photometric method and calcium content was estimated by Versenate method (Jackson, 1973).

III. RESULTS AND DISCUSSION

The data presented in Table 1 below indicates the influence of salicylic acid and prohexadione-calcium on leaf nutrient status of apple trees. Present studies reveal that highest leaf N (2.58 and 2.70 %), P (0.33 and 0.38 %), K (2.07 and 2.13 %) and Ca (2.20 and 2.23 %) content was recorded in trees sprayed with salicylic acid @ 150 ppm + prohexadione-calcium @ 600 ppm and lowest leaf N (2.01 and 1.98 %), P (0.12 and 0.16 %), K (1.75 and 1.78 %) and Ca (1.57 and 1.62 %) content was recorded in trees receiving no treatment (control).The maximum leaf N, P, K and Ca content as a result of salicylic acid and prohexadione-calcium may be attributed to the fact that salicylic acid increases the uptake and movement of nutrients in plants thus increasing their concentration in leaves and prohexadione-calcium reduces leaf area and thus leaf dry matter decreases. Since leaf nutrient content is expressed on dry matter basis, hence leaf N, P, K and Ca content increases when dry matter decreases. Another reason for higher leaf N, P, K and Ca content as a result of prohexadione-calcium may be due to the fact that it stimulates root growth at the cost of shoot growth as a result of which there is more uptake of minerals. These results are in line with the findings of Shaaban *et al.,* (2011) and Guak, (2013) who observed that leaf nutrient content of apple trees increased as a result of application of salicylic acid and prohexadione-calcium respectively. Similar results have been confirmed by Jamali *et al.,* (2011) in strawberry and Szepsi *et al.,* (2009) in tomato.

Table 1. Effect of salicylic acid and Prohexadione-calcium on leaf nutrient content (%) of apple trees cv, Red Delicious

Treatments	Leaf N		Leaf P		Leaf K		Leaf Ca	
	2014	2015	2014	2015	2014	2015	2014	2015
T_1 : Control	2.01	1.98	0.12	0.16	1.75	1.78	1.57	1.62
T_2: Salicylic acid @ 50 ppm	2.03	2.05	0.14	0.19	1.77	1.81	1.60	1.65
T_3: Salicylic acid @ 100 ppm	2.18	2.22	0.20	0.25	1.85	1.87	1.90	1.93
T_4: Salicylic acid @ 150 ppm	2.31	2.37	0.27	0.29	1.92	1.95	1.98	2.03
T_5: Salicylic acid @ 200 ppm	2.15	2.20	0.18	0.23	1.83	1.86	1.86	1.89
T_6: Prohexadione-Ca @ 600 ppm	2.38	2.47	0.26	0.30	1.94	1.98	2.09	2.12
T_7 : Salicylic acid @ 50 ppm + Prohexadione-Ca @ 600 ppm	2.41	2.50	0.28	0.32	1.96	2.01	2.11	2.14
T_8 : Salicylic acid @ 100 ppm + prohexadione-Ca @ 600 ppm	2.53	2.65	0.30	0.34	2.02	2.08	2.13	2.16
T_9 : Salicylic acid @ 150 ppm + prohexadione-Ca @ 600 ppm	2.58	2.70	0.33	0.38	2.07	2.13	2.20	2.23
T_{10} : Salicylic acid @ 200 ppm + prohexadione-Ca @ 600 ppm	2.33	2.43	0.24	0.27	1.90	1.92	2.07	2.10
C.D at 5%	0.11	0.15	0.03	0.04	0.03	0.05	0.06	0.05

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