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Impact Of Front Line Demonstration On Foliar Application Of Arka Citrus Special In Sweet Orange

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ABSTRACT
A demo was conducted at farmer's field under Front Line Demonstrations during 2012-13 to 2014-15 in Krishi Vigyan Kendra, Kalyandurg, Anantapur district of Andhra Pradesh, to study the application of micronutrients as foliar spray in sweet orange with Arka Citrus Special a research formula of IIHR, Bangalore, it's a crop specific micronutrient foliar spray for higher and quality yield in citrus fruits. The results showed that, the foliar spray with Arka Citrus Special @ 5g/lit(T_1) all the yield attributing characters viz., number fruits per tree (337), weight per fruit (149.4 g), fruit yield per tree (50.80 Kg), yield per hectare (13.22 t). The minimum of these entire yield attributing were obtained in control (T_2) where no spraying with Arka Citrus Special. When the foliar spray with Arka Citrus Special the yield response was 25.4 per cent, benefit cost ratio 6.8 and net returns Rs. 2, 03, 146/- increase over the control.
***Key words: S**weet orange, Arka Citrus Special, foliar spray, IIHR, fruit yield.*

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INTRODUCTION

The productivity of sweet orange in India is significantly lower than in some of the frontline citrus growing countries like Brazil, USA, Spain and Italy (30 to 35 t/ha). Similarly, the average productivity of sweet orange orchards (14.9 t/ha) is comparatively lower among the different sweet orange varieties. One of the main reasons for low sweet orange orchard productivity in the soils of Andhra Pradesh region is multiple nutrient deficiencies. The soils of this region are mostly derived from basaltic parent material and are commonly deficient in multiple nutrients, including N, P, B, Fe, Mn, and Zn; that is why the conventional nutrient management strategy based mainly on macronutrient application in citrus orchards has not been very successful in raising the productivity level (Srivastava *et al*., 2009). Relatively, small amount of micronutrient is required as compared to those of primary nutrients, but these are equally important for plant metabolism (Katyal, 2004). Even though micronutrients are present in soil, their absorption may be hindered by other nutrients by interaction between nutrients.

For instance, zinc deficiency often occurs due to heavy phosphate application. Manganese deficiency occurs especially due to over liming, heavy phosphate application and excess of Iron, Copper and Zinc in the soil. Copper deficiency is induced by heavy liming and excessive application of nitrogen and phosphate on the yield of crops could be improved with little quantities of micronutrients applied either singly or in mixtures through soil or foliar feeding (Malewar, 2005).

Micronutrient plays many complex roles in plant nutrition and plant production, while most of micronutrients participate in the functioning of number of enzyme systems, there is considerable variation in the specific functions of the micronutrients in plant and microbial growth processes, for example, copper, iron and molybdenum are capable of acting as electron carriers in the enzyme system that bring about oxidation reduction reactions in plants. Such reactions are essential steps in photosynthesis and many other metabolic processes. Zinc and manganese functions in many enzyme systems as bridges to connect the enzyme with the substrate upon which it is meant to act (Rajaie *et al*., 2009). The productivity of sweet orange mainly depends on adequate supply of plant nutrients seems to be a very important factor in regulating cropping and influencing the quality of sweet orange. However,

our knowledge regarding fertilizer and requirement, time of fertilization, form of fertilizer, method of application etc. it still incomplete and more work is needed on these aspects. Evergreen sweet orange is nutrient loving plant and all essential elements have been known to have important role to play for proper growth and development of sweet orange. The sufficient supply of nutrient not only for development of vegetative structure and flowers but also to give regular harvest of quality fruits. Inadequate plant nutrition causes serious disorders in sweet orange and many eventually lead to decline the orchards. On the other hand, proper fertilization of sweet orange trees ensures high yield and good quality fruits year after year. Therefore constant vigilance is required to maintain an optimum nutritional level for maximum production of high quality fruits. (Bose *et al*., 1998). Foliar feeding has been used as a means of supplying supplemental doses of minor and major nutrients, plant hormones, stimulants and other beneficial substances. Therefore, judging which foliar materials to apply and at what plant stage to spray with soil applied organic and inorganic fertilizers are important principles to make best uses of this technique.

Nutrient management is one of the most important factor in improving the plant growth and yield through increasing photosynthetic efficiency. Micronutrients deficiency in soil and plants is a worldwide nutritional problem and very severe in many countries (Alloway, 2008). In Anantapur, the nutrient deficiencies particularly micronutrients are common due to climate and nature of soil. By choosing appropriate fertilizer rates, the grower can drive a crop toward earlier and heavier fruit setting (Alva *et al*., 2006). Micronutrients like Zinc and Boron are very important for optimal plant growth, physiological and biochemical pathways in citrus cultivation under climatic conditions of Anantapur. The application of Zinc improves the citrus fruit yield and its juice quality (Ashraf *et al*., 2014). Foliar or soil application of zinc increases the biosynthesis of chlorophyll and carotenoid synthesis that are important for proper performance of photosynthetic process. Foliar application of Zinc had positive impact on fruit yield and quality of sweet orange, Kinnow mandarin and grapes (Razzaq *et al.,* 2013). Similarly, application of B with Zn enhanced the juice content (Ram et al., 2000). Application of B increases fruit set and yields by its role in pollen tube germination and elongation (Abd-Allah, 2006) and increases growth and flowering in tomatoes (Naz *et al.,* 2012). The foliar application of Zn and B significantly enhanced fruit yield and juice content, total soluble solids, ascorbic acid and non reducing sugar (Asad *et al.,* 2003). Under various application techniques and their effects on Indian conditions, no systematic work was carried out on the role of multi-micronutrient in sweet orange and qualitative as well as quantitative production. Hence, this present demonstration was planned to the effect of multi-micronutrient of Arka Banana Special as a foliar spray on yield parameters of sweet orange.

MATERIALS AND METHODS

Krishi Vigyan Kendra, Kalyandurg, has conducted 36 FLDs under real farming situations between 2012 and 2015 in 11 different villages located in different blocks under KVK operational area. Experimental research design was used for the study total population of 36 farmers (N=36) in whose plots FLDs were conducted along with control plot was taken into consideration for the study to find out the effect of multi-micronutrient of Arka Citrus Special as a foliar spray on yield parameters of sweet orange. The area under each demonstration was 0.4 ha from each location consisting of 0.4 ha each of demo and control plots. The details are given in Table.1.

The demonstration comprised of two treatments *viz*., T_1- Arka Citrus Special as a foliar spray and T_2- Farmers practice (without any micronutrient spraying). The composition of Arka Citrus Special (Research formulation of IIHR) is Zinc-6.1 %, Boron-0.5 %, Manganese-0.5 %, Iron-1 %, Copper-0.1 %. The method used for the experiment involved mix 75 g of Arks citrus special + one shampoo sachet + one lemon fruit juice in 15 liters of clean water, mix thoroughly before spray. Spray before 1 month flowering & continue sprays at regular monthly intervals upto 2 months prior to harvesting of fruits. Spraying on fruits on emergence will improves fruit size, color, quality and taste. It's a faster correction of deficiency, less fertilizer consumption, early crop and good yield, big size fruits and good colour. Spray timing should be done between 6-11 am and 4-6.30 pm. Arka citrus special mixture can be mixed with any of the fungicides and pesticides except copper based. Technology effectiveness is the intervening variable which refers to the performance of technology in terms of quality and yield of banana. Data on yields, expenditure incurred by the farmer on control (Farmer's practice) and demo plots were collected and analyzed. Gross income was calculated based on local market prices of banana and net income by subtracting the total cost of cultivation from gross income. Benefit: cost ratio was computed by dividing gross returns with cost of cultivation.

TABLE 1: Particulars of Front Line Demonstration

Sl. No	Year	No. of villages	No. of locations	Area (ha)	
				Demo	Control
1	2012-13	3	7	2.8	2.8
2	2013-14	5	20	8.0	8.0
3	2014-15	3	9	3.6	3.6
	Total	11	36	14.4	14.4

Foliar spraying of Arka Citrus Special on sweet orange

RESULTS & DISCUSSION

Yield attributes

Due to application of micronutrients as foliar spray in sweet orange with Arka Citrus Special a marked effect on yield characteristics was observed in the present demo. The yield performance indicators are presented in Table 2.

TABLE 2: Effect of Arka Citrus Special as foliar spray on yield characteristics of sweet orange

Year	Number of fruits/tree		Fruit weight (g)		Fruit yield/tree (Kg)	
	Demo	Control	Demo	Control	Demo	Control
2012-13	214	192	143.29	128.48	30.70	24.70
2013-14	364	339	148.67	136.41	54.10	46.20
2014-15	433	387	156.34	141.94	67.69	54.90
Average	337	306	149.40	135.60	50.80	41.90

The data presented in Table 2 revealed that under demo plot, the performance of fruit yield was found to be substantially higher than that under control (farmer practices) during all the years (2012-13 to 2014-2015). The Number of fruits per tree of sweet orange under demo recorded were 214, 364 and 433/tree in compared to control 192, 339 and 387/tree during 2012-13, 2013-14 and 2014-15 respectively. The

cumulative effect of technological intervention over three years, revealed an average number of fruits were 337/tree in compared to control 306/tree. Ghosh and Basra (2000) also reported highest number of fruits in sweets orange due to combined application of micronutrient along with NPK. The fruit weight per tree of sweet orange under demo recorded were 143.29 g, 148.67 g and 156.34 g/fruit in compared to control 128.48 g, 136.41 g and 141.94 g/fruit during 2012-13, 2013-14 and 2014-15 respectively. The cumulative effect of technological intervention over three years revealed an average number of fruits were 149.40 g/fruit in compared to control 135.60 g/fruit.

The fruit yield per tree of sweet orange under demo recorded were 30.70 Kg, 54.10 Kg and 67.69 Kg/tree in compared to control 24.70 Kg, 46.20 Kg and 54.90 Kg during 2012-13, 2013-14 and 2014-15 respectively. The cumulative effect of technological intervention over three years revealed an average number of fruits were 50.80 Kg/tree in compared to control 41.90 Kg/tree. Tariq *et al.,* (2007) observed that application leads to more number of fruits in sweet orange and yield were increased significantly. Yield parameters like number of fruits per tree, weight of fruits per tree and productivity per hector as influenced by use of multi nutrients.

The data presented in Table 3 revealed that under demo plot, the performance of sweet orange yield was found to be substantially higher than that under control (farmer practices) during all the years (2012-13 to 2014-2015). The yield of sweet orange under demo recorded was 4.33, 16.25 and 19.08 t/ha in compared to control 4.12, 14.4 and 17.22 t/ha during 2012-13, 2013-14 and 2014- 15 respectively. The cumulative effect of technological intervention over three years, revealed an average yield of 13.22 t/ha, 25.4 per cent higher over control. From the long term (16 years) micro-nutrient trial with mandarian orange cv. Coorg, Shrivastava *et al*. (1981) reported that plants sprayed with Cu, Mn, and Zn gave significantly higher fruit yield than the untreated controlled plant. The year-to-year fluctuations in yield and cost of cultivation can be explained on the basis of variations in prevailing social, economical and microclimatic condition of that particular village. However, Economic indicators i.e. gross expenditure, gross returns, net returns and BC ratio of Front Line Demonstration are presented in Table 3.

The data clearly revealed that, the net returns from the demo plot were substantially higher than control plot, *i.e*. farmers practice during all the years of demonstration. Average net returns from demo plot were Rs. 2,03,146/ha in compared to control *i.e*. Rs.1,78,116/ha. The gross expenditure from the demo plot were Rs. 34,814/ha in compared to control Rs. 36,324/ha. The gross returns from the demo plot were Rs. 2,37,960/ha in compared to control Rs. 2,14,440/ha. Economic analysis of the yield performance revealed that benefit cost ratio of demonstration plots were observed significantly higher than control plot *i.e*., farmer practice. The cumulative effect of technological intervention over three years, revealed an average benefit cost ratio were 6.8 in compared to control 5.90. The response of fertilization in improving the growth, yield and quality and benefit cost ratio of different citrus fruits is well recognized (Shukla *et al.,* 2000). Calvert (1970) has reported that significant role of N, P, Mg, Zn, and B on growth, yield and quality of citrus fruits in India. Huchche *et al*., (1998) also reported that application of chemical fertilizers along with organic soil amendments increased mandarin yield and economics in India.

TABLE 3: Cost economics of foliar spraying of Arka Citrus Special in sweet orange

Year	Yield (t/ha)		% of increase	Cost of cultivation (Rs/ha)		Gross returns (Rs/ha)		Net Return (Profit) / unit (Rs/ha)		B: C ratio	
	Demo	Control		Demo	Control	Demo	Control	Demo	Control	Demo	Control
2012-13	04.33	04.12	05.10	25000	26500	77940	74160	52940	47660	3.1	2.8
2013-14	16.25	14.40	12.80	40852	41143	292500	259200	251648	218057	7.2	6.3
2014-15	19.08	17.22	10.80	38589	41328	343440	309960	304851	268632	8.9	7.5
Average	13.22	11.91	25.40	34814	36324	237960	214440	203146	178116	6.8	5.90

CONCLUSION

The foliar application of Arka Citrus Special @ 5g/lit on sweet orange during 2012-13 to 2014-15 gave maximum fruit yield and good quality fruits and higher profit gain by correcting these micronutrient deficiencies. Therefore, the application of this dose of micronutrients will improve yield and fruit quality in sweet orange by correcting the micro nutrient deficiencies and the orchardist will be economically benefited

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