Fruit Quality Enhancement in Passion fruit (*Passiflora edulisf. edulis* Sims.) Through Pruning and Foliar Nutrition

ABSTRACT

An experiment was carried out at Department of Fruit Science,College of Agriculture, Vellayani, Kerala Agriculture University to insight into the impact of pruning intensity and foliar nutrition on quality parameters of passion fruit(*Passiflora edulisf. edulis* Sims.) with 12 treatments replicated thrice in RandomisedBlockDesign. Various level of pruning intensities and foliar nutrition were given to the plants. The study revealed that combined application of 50% pruning and foliar nutrition of 19:19:19@1% along with Sampoorna KAU micronutrient mixture @1% reduced the titrable acidity and recorded highest value for TSS, total sugar, reducing sugar, ascorbic acid, carotenoid content whereas control plants reported lowest values for these characters. Rind and pulp colour was also improved in this treatment. Highest non-reducing sugar content was recorded in the treatment which received 75% pruning and foliar nutrition of 19:19:19@1% along with Sampoorna KAU micronutrient @1%.

Keywords: Passion Fruit pruning, foliar nutrition, micronutrient

1. INTRODUCTION

Passion fruit is a prominent member of the family Passifloraceae with 600 species, mostly distributed in tropical and subtropical regions. Thefruit stands out not only for its exotic unique flavour and aroma but also for its amazing nutritional and medicinal properties. Its fruits are used for fresh consumption and processing purpose.Proper canopy management and balanced nutrition plays a vital role in plant growth, yield and fruit quality of Passion fruit. Reduction in vigour of the crop after few years of growing is a major problem in passion fruit cultivation. Flower and fruit development of passion fruit takes place only on the current season's growth; hence all vines older than one year are unfruitful. Therefore, pruning of old and dead branches that have already born fruit is a necessary practice. Passion fruit is a highly nutrient responsive

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crop. So along with pruning, foliar application of nutrients helps in rejuvenation of the crop and it will also increase the fruit yield. Foliar feeding of nutrients is an effective tool for reducing the quantum of soil applied nutrients and thereby enhancing the nutrient use efficiency.Foliar spray of nutrients has many advantages like low application rates, uniform distribution of fertilizers and sudden and effective response from plant.Micronutrients and secondary nutrients play a major role in crop production due to their essentiality in plant metabolism and adverse effect that manifest due to their deficiency. However, no systematic attempts have been made to study these aspects. Keeping this in view, the present study is aimed to find out the effect of different pruning intensities and rejuvenation through foliar nutrition on quality improvement of passion fruit.

2. MATERIALS AND METHODS

2.1 Experiment site

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The present study was conducted at the Department of Fruit Science, College of Agriculture, Vellayani. The Field experiment was conducted at RARS Ambalavayal.

2.2 Experimental Material

The study was conducted in one year old standing crop of passion fruit variety 134P, during 2020-2021. The objective of the experiment was to standardise the effects of various levels of pruning and foliar nutrition on quality of passion fruit. One year old plants were pruned and basal dose of fertilizers were applied to the plants.

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2.3 Experimental Details

The experimental design was randomised block design with 12 treatment combination of different pruning intensities and rejuvenation of pruned vines through foliar nutrition,

2.4 Treatment Details

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T_1-removing quarter portion (25%) of current fruiting branch + 19:19:19 @ 1 % , T_2 - removing quarter portion (25%) of current fruiting branch + 19:19:19 @ 1 % + Sampoorna KAU micronutrient mixture @1 % T_3 - Removing quarter portion (25%) of current fruiting branch + Water spray (control) T_4 – Removing half portion (50%) of current fruiting branch +19:19:19 @ 1 % T_5 – Removing half portion (50%) of current

fruiting branch +19:19:19 @ 1 + Sampoorna KAU micronutrient mixture @1 % T_6 – removing half portion (50%) of current fruiting branch + water spray (control) T_7- removing three quarter portion (75%) of current fruiting branch +19:19:19 @ 1 T_8 - removing three quarter portion (75%) of current fruiting branch + 19:19:19 @ 1 + Sampoorna KAU micronutrient mixture @1 % T_9 –removing three quarter portion (75%) of current fruiting branch + water spray (control) . T_{10} – no pruning (control) + 19:19:19 @ 1 T_{11}- no pruning (control) + 19:19:19 @ 1 + Sampoorna KAU micronutrient mixture @1 % and T_{12} –.no pruning (control) + water spray (control). replicated thrice and the significance was tested using analysis of variance technique.

Soil and foliar application of treatments: Application of different treatments were started one month after pruning in the main field. Ad hoc Package of Practice Recommendation of passion fruit (80 N: 30 P_2O_5: 60 K_2O (g $vine^{-1}$) and FYM 10 kg $vine^{-1}$ (Joy, 2010) were given uniformly to all treatments as soil application. Rejuvenation of vines using foliar nutrition was done at three times- onemonths after pruning, at time of flowering and fruiting (Fig.3). Observations were recorded up to one year after pruning.

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3. RESULT AND DISCUSSION

3.1 TSS AND SUGAR ACID RATIO

The combination of pruning intensity and foliar application revealed significant difference on quality parameters of the fruits.Combined application of 50% pruning and foliar nutrition of 19:19:19@1% + Sampoorna KAU micronutrient @1%(T_5)recorded maximum TSS (20.47°brix), which was significantly different from all other treatments whereas control plants reported lowest values for these characters (Table 1). Sugar acid ratio was found to be maximum for T_4 (14.61) and was on par with T_5 (14.59).The results are also in similarity with Premalatha and Suresh (2019) and Bindu (2019) who reported that application 3% micronutrient mixture increases sugar/acid ratio in banana. Similar results are obtained by Nehete*et al*. (2011) in mango, Yadav *et al.* (2010) in banana cv. Grand Naine. Patel *et al*. (2010) in banana cv. Basrai, Bindu and Bindu (2017) in papaya, Kavitha*et al*. (2000) in papaya. The rise in TSS and sugar acid ratio due to micronutrient application might be related to an increase in photosynthetic activity, sugar

translocation from source to sink, and polysaccharide conversion to simple sugars, all of which are attributable to enhanced enzyme activities by zinc.Findings of Tyagi *et al*. (2017) is in accordance with the current study where, the enzymes involved in converting polysaccharide into simple sugars, which raises the TSS of fruits, would have been triggered by zinc and potassium, which regulate the enzymatic activity in plants.

3.2 ACID CONTENT

The lowest value for acidity was recorded for T_{4-} removing half portion (50%) of current fruiting branch +19:19:19 @ 1 % (1.04 %) which was on par with T_2 (1.12%), T_5 (1.13%), T_7 (1.23%) and differed significantly from other treatments(Table 1). The ascorbic acid content in passion fruit was noticed to be highest in T_5 (34.11mg 100 g^{-1}) which was on par with T_2 (31.54 mg 100 g^{-1}), T_4 (28.42) and significantly differ from all other treatments. The acidity of fruits reduced following the application of zinc sulphate which can be related to higher build-up of total soluble solids. Due to the availability of metabolites necessary for ascorbic acid production, zinc treatment also resulted in an increase in ascorbic acid (Kavitha *et al*., 2000).

3.3 CAROTENOID CONTENT

Persual of the data in table 1 reveals that carotenoid content in pulp of passion fruit were the highest for T_5 (2.89 mg 100 g^{-1}) which was on par with T_4 (2.80 mg 100 g^{-1}). Total carotenoids concentration was favourably influenced by pruning severity and was greatest in trees that had been moderately pruned (Singh *et al*. 2010). According to Rodrigo and Zacarias (2010), zinc sulphate at a concentration of 4-6% raised the carotenoid content of *Citrus sinensis* and *Citrus reticulata*.The foliar application of micronutrient might have increased the carotene content of passion fruit by improving the carotene synthesis.

3.4 SUGAR CONTENT

Total sugar (16.27 %) and reducing sugar (11.78 %) content of the fruit was found to be maximum on combined application of 50% pruning and foliar nutrition of 19:19:19@1% + Sampoorna KAU micronutrient @1% (T_5) and was significantly different from all other treatments (Table 2). According to Singh *et al.* (2010) and

Singh *et al*. (2000), foliar spraying of zinc and boron increased the sugar fraction, which may be attributable to their presence as well as to their involvement in the translocation of sugars from one part of the plant to another part that is still developing and in the photosynthesis of metabolites.

More total sugar accumulation may be caused by carbohydrate conversion, hexokinase activity, and starch breakdown into sugar due to the role of zinc, which catalyses the oxidation-reduction process in plants (Bhalerao and Patel, 2015).

Reduced competition between metabolites, fewer bunches per vine, and the availability of more photosynthates as a result of better vigour and physiological activity induced in them where source-sink relationships were well balanced may all contribute to the accumulation of high reducing and total sugars in balanced pruning of vegetative and reproductive growth (Gopu*et al.,* 2014).However,non-reducing sugar content was the lowest for treatment T_3 (3.18 %) which was on par with T_{11} (3.78%), T_6 (3.78%), T_{10}(3.96%) and T_{12} (4.09%) and differed significantly different from other treatments (Table 2).

3.5 SHELF LIFE

The data recorded for shelf life indicated that the longest shelf life was recorded for the treatment T_5 (7.13 days) which is on par with T_4 (6.53days), T_8 (6.13days) and significantly different from all other treatments (Table 2). The trees treated with $ZnSO_4$ 0.5%+ 0.5% $FeSO_4$ + 0.3% B in sapota had the longest shelf life (Thirupathaiah, 2017). Kumar *et al*. (2006) reported that, K application improves storage and shipping quality and extends shelf life in fruit crops. It is attributed to an increase in photosynthetic activity throughout development, and optimal levels simulate cell wall integrity. Similar outcomes were obtained by Pathak and Mitra, (2008).

3.6 SENSORY EVALUATION

Organoleptic evaluation for sensory quality of fruit was done by a panel of judges from various age groups using a 9-point hedonic scale to assess its appearance, colour, flavour, texture, taste, and overall acceptability.Pruning 50% of the current fruiting branch along with foliar application of 19:19:19 @ 1% and Sampoorna KAU

Micronutrient mix @ 1% resulted in highest mean score for organoleptic characters like appearance, colour, flavour, taste and overall acceptability in passion fruit.

The highest ratings for taste in fruits during organoleptic evaluation were achieved due to the addition of potassium sources, which balances the sugar acidity levels in plants (Patil and Patil, 2017). Similar results were found by Bhoyar and Ramdevputra (2016), who found that adding 0.5% Zn SO4 and 0.5% FeSO4 to guava increased its aroma, taste, flavour, texture, and overall acceptance. Along with playing a critical part in the production of auxins, which are essential to plants, zinc is engaged in a variety of enzymatic processes. A lot of enzymatic processes also use it as a catalyst. As a result, complex sugars are converted into simple sugars, such as starch is converted into glucose or fructose. the formation of flavoproteins being connected to iron. Additionally, zinc's effect on zymohexose is responsible for its involvement in hexokinase activity, the production of cellulose, and the modification of sugars (Dutta and Dhua, 2002).

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4. CONCLUSION

Overall assessment of the fruit quality parameters revealed apositive response in the qualitative characters like TSS, total sugar, reducing sugar, non-reducing sugar, sugar/acid ratio, ascorbic acid and total carotenoids with combined application of pruning and foliar nutrition of primary and micro nutrients. The study revealed that combined application of 50% pruning and foliar nutrition of 19:19:19@1% along with Sampoorna KAU micronutrient @1% reduced the titrable acidity and recorded maximum TSS, total sugar, reducing sugar, ascorbic acid, carotenoid content whereas control plants reported lowest values for these characters. Rind and pulp color were also improved in this treatment. Highest non-reducing sugar was recorded in the treatment which received 75% pruning and foliar nutrition of 19:19:19@1% along with Sampoorna KAU micronutrient @1%

Table 1. Effect of pruning and foliar nutrition on TSS, acidity, total carotenoids, ascorbic acid and sugar/ acid ratio in passion fruit

Treatments	TSS (°brix)	Acidity (%)	Total Carotenoids(mg100g^{-}	Ascorbic acid	Sugar/acid ratio

			^{1})	(mg100g^{-1})	
T_1	18.03	1.44	2.51	26.35	9.09
T_2	18.77	1.12	2.62	31.54	10.90
T_3	17.47	2.11	2.11	23.25	5.61
T_4	19.30	1.04	2.80	28.42	14.61
T_5	20.47	1.13	2.89	33.44	14.59
T_6	18.67	1.51	2.80	20.58	8.12
T_7	17.30	1.23	2.56	23.97	12.27
T_8	18.70	1.65	2.73	26.64	7.58
T_9	16.43	2.23	2.15	17.05	6.48
T_{10}	16.20	2.28	1.89	21.70	5.34
T_{11}	16.37	2.36	2.02	24.80	4.88
T_{12}	15.20	2.60	1.43	20.15	4.28
SEm(±)	0.20	0.15	0.06	2.01	0.59
CD(0.05)	0.60	0.11	0.13	5.89	1.73

Table 2. Effect of pruning and foliar nutrition on total sugars, reducing sugars and nonreducing sugar in passionfruit.

Treatments	Total sugars (%)	Reducing sugars (%)	Non reducing sugars (%)	Shelf life of fruit (days)
T_1	14.42	9.48	4.95	5.53
T_2	14.95	10.36	4.59	5.67
T_3	11.79	8.61	3.18	4.93
T_4	15.14	9.65	5.49	6.53
T_5	16.27	11.78	4.48	7.13
T_6	12.25	8.56	3.78	6.03
T_7	14.51	8.44	6.07	5.87
T_8	14.77	8.23	6.54	6.13
T_9	10.78	5.64	5.13	4.80

T_{10}	12.22	8.26	3.96	5.13
T_{11}	11.55	7.77	3.78	5.47
T_{12}	10.25	6.16	4.09	4.27
SEm(±)	0.40	0.32	0.38	0.37
CD(0.05)	1.16	0.95	1.10	1.09

Fig. 1. Effect of pruning and foliar nutrition on organoleptic characters in passion fruit

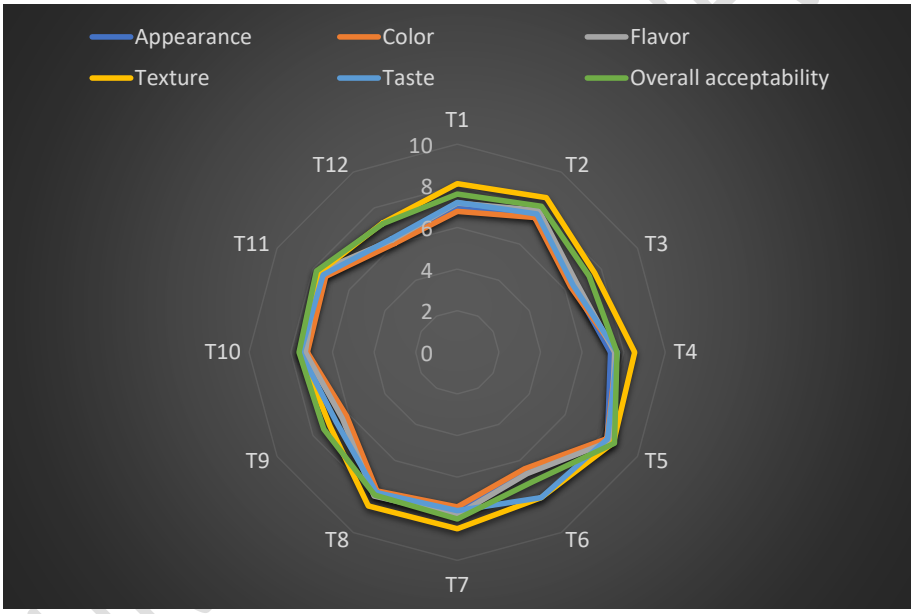

Fig. 2. Effect of pruning and foliar nutrition on TSS, carotenoids and total sugar

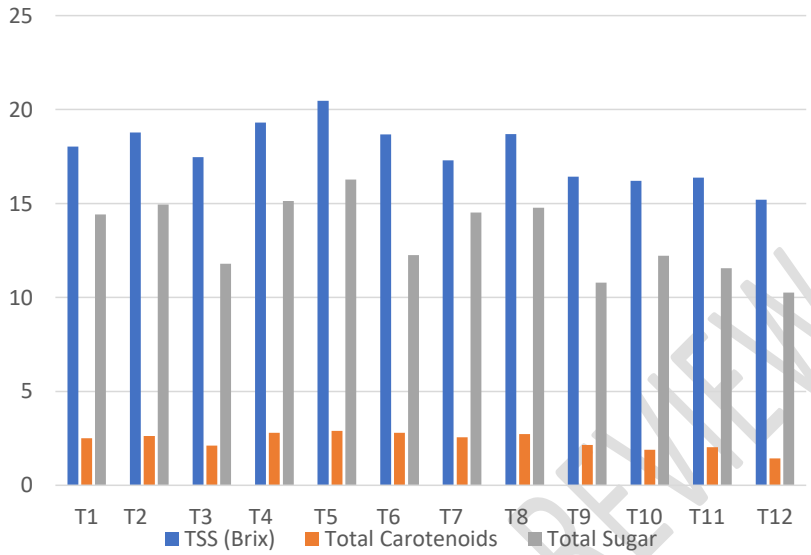

Fig. 3. Passion fruit plot after pruning

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