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Influence of nutrients and shoot retention on reproductive characters and yield in rejuvenated guava (*Psidium guajava* L.) cv. Sardar

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Abstract
A study on the influence of nutrients and shoot retention on growth and yield in rejuvenated guava was conducted during 2018-2019 in the Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi (UHS, Bagalkot), Karnataka. Among shoot thinning, number of days for initiation of flowering (71.36), 50% flowering (81.17), completion of flowering (87.61) was least in 3 shoots per branch (S_1), number of flowers per shoot and flowers per plant (25.18 and 75.85) were more in 4 shoots per branch (S_2). Days for initiation of fruiting (86.33), 50% fruiting (97.96) and completion of fruiting (120.22) was least in S_1. Number of fruits per plant (69.28) and yield (10.25 kg/plant) was highest in S_2. Nutrient had significant effect on flowering and fruiting parameters in rejuvenated guava. Plants supplemented with 100% RDF (200: 80: 150 NPK g/plant) + (Zn+B+Mg) 0.3% each (F_6) has early initiation of flowering (71.72), 50% flowering (81.56), completion of flowering (87.56), higher number of flowers per shoot and flowers per plant (24.67 and 75.93), least days for initiation of fruiting (87.56), 50% fruiting (98.00) completion of fruiting (118.78), maximum number of fruits per plant (69.14) and yield (10.90 kg/plant). Interaction effect has got non-significant results for all the parameters. However, the treatment S_1F_6 flowers and fruit early but S_2F_6 has higher number of flowers per shoot and plant, maximum fruits per plant and yield.

Keywords: Guava, rejuvenation, shoot retention, nutrients

Introduction
Guava (*Psidium guajava* L.) is one of the most important fruits of the tropics and sub-tropics of the world. It belongs to family Myrtaceae and is aptly called as 'Apple of the tropics'. It was introduced to India during the 17th century by the Portuguese to Goa (Menzel and Paxton, 1985) [7]. This fruit occupies an important place in the horticultural wealth of our nation. It is very nutritious having vitamin C (75-260 mg/100g pulp) (Shukla *et al*., 2008) [12]. Fruits are preferred for fresh consumption as well as different processed products like jam, jelly, cheese, nectar etc. All parts of the plant used for different medicinal purposes *viz.*, hepatoprotection, antioxidant, anti-inflammatory, antispasmodic, anti-cancer, antimicrobial, anti-hyperglycemic, analgesic, anti-stomachache and anti-diarrhea (Barbalho *et al*., 2012) [2]. For overcoming the problem of unproductive and uneconomic orchards existing in abundance, large scale uprooting and replacement with new plantations (rehabilitation) is long term and expensive strategy. The rejuvenation technology involves the heading back of exhausted trees (showing marked decline in annual production and quality of produce) to 1.0 to 1.5-meter height above the ground level during May-June or December-February to facilitate the production of new shoots from below the cut point and allow the development of fresh canopy of healthy shoots (Jahangeer *et al*., 2011) [5]. Pruning helps to balance between vegetative and reproductive growth of the plant. The thinning of shoots per branch is also one of the canopy management practices in the rejuvenation of old orchards (Bhagawati *et al.*, 2015) [3]. Nutrients can be made available to the plants by the basal as well as foliar application. Nitrogen, phosphorus and potassium are the major and essential nutrients required by the plants in larger quantities. These are responsible for maximizing physiological activities of the plant which ultimately affect the growth, development, flowering, fruiting and quality until the fruits attain physiological maturity (Nijjar, 1996) [8]. Hence, the present investigation was undertaken to study the influence of nutrients and shoot retention on flowering and fruiting characteristics in rejuvenated guava cv. Sardar.

Materials and Methods

An experiment was carried out in the fruit science departmental orchard, The experiment was laid out in factorial randomized completely block design (FRCBD) and replicated thrice as follows, The factor 1 consists of 3 levels of thinning, *i.e.* retaining three shoots per branch (S_1), four shoots per branch (S_2) and Five shoots per branch (S_3).Shoot thinning was done in the 1st week of June. Factor 2 consists of 6 different nutrient levels *viz*., 50% RDF (100: 40: 75 NPK g/plant) + (Zn+B+Mg) 0.2% each(F_1), 50% RDF (100: 40: 75 NPK g/plant) + (Zn+B+Mg) 0.3% each (F_2), 75% RDF (150: 60: 110 NPK g/plant) + (Zn+B+Mg) 0.2% each (F_3), 75% RDF (150: 60: 110 NPK g/plant) + (Zn+B+Mg) 0.3% each (F_4), 100% RDF (200: 80: 150 NPK g/plant) + (Zn+B+Mg) 0.2% each (F_5), 100% RDF (200: 80: 150 NPK g/plant) + (Zn+B+Mg) 0.3% each (F_6). Recommended doses of fertilizers were applied on per plant basis according to the treatment details in two split doses. 50 per cent of urea was applied in the month of July as basal dose and the remaining 50 per cent urea and full dose of single super phosphate and muriate of potash as top dress applied during October. Micro nutrients like zinc in the form of $ZnSo_4$, boron in the form of borax and magnesium in the form of $MgSo_4$ sprayed before and after flowering as per the treatments.

Results and Discussion

The flowering and fruiting parameters were significantly influenced by different treatments. Plants retained with 3 shoots per branch has resulted in early flowering and fruiting. Number of days for initiation of flowering (71.36), 50% flowering (81.17), completion of flowering (87.61) were least in 3 shoots per branch. The shoot sprouts appear little early after pruning which may be due to immediate loss of apical dominance and due to early shoot production, these shoots attained the desired maturity to give rise to early panicle emergence which was reported by Singh *et al.* (2010) [13] in mango, and also due to the increased vigor of the emerging shoots as the pruning severity was increased and early commencement of flowering with the increased pruning severity which was in line with the findings of Pawan *et al.* (2017) [9] in mulberry. Higher number of flowers per shoot and per plant (25.18 and 75.85) was recorded in 4 shoots per branch which is due to moderate pruning helped in establishing optimal balance in root to shoot ratio and endogenous hormonal contents, *i.e.* growth promoter: inhibitor ratio which was also found by Singh *et al.* (2010) [13] in mango. Since, flowering in guava occurs on current season growth, therefore pruning helps in getting new fruiting units and thus increases the number of flower/shoots which was also reported by Dhaliwal *et al.* (2000) in guava. Number of days for initiation of fruiting (86.33), 50 per cent fruiting (97.96) and completion of fruiting (120.22) were least in 3 shoots per branch. The pruning intensity increases, number of fruits per plant decreases. So, the inter fruit competition for nutrient is decreased and fruit size increases and leaf to fruit ratio increases that enhanced the fruit maturation at a faster rate which was reported by Lawande *et al.* (2014) [6] in jamun and Sahoo *et al.* (2017) [10] in sapota so sever pruned plant took minimum time to fruit mature followed by moderately pruned plant. So plants pruned with 4 shoots per branch has maximum fruits per plant (69.28)) and yield (10.25 kg/plant).

Among nutrition plants with F_6 has got least number of days for initiation of flowering (71.72), 50% flowering (81.56), completion of flowering (87.56). The optimum dose of nutrient combinations (NPK) accelerates the metabolic activities of the plant by increasing the meristematic activities which in turn increases the vegetative growth and ultimately lead to initiation of flowering and maximum fruit setting per cent. These results are in accordance with Sharma and Sharma (1992) [11], Umashankar *et al.* (2002) [15] in guava and the combined effect of different micronutrients might have played a vital role in increase of physiological activities leading to early initiation of flowering in guava, the similar results were in mango which was reported by Banik and Sen (1997) [1]. Higher number of flowers per shoot, and plant (24.67 and 75.93) were recorded in F_6, this may be due to better photosynthesis recording good growth and formation of a greater number of flowers. The primitive effect of N and K in rapid production of leaves with better photosynthetic activity resulting in higher C: N ratio for flowering and fruit set. The present findings were in line with Turner and Barkus (1982) [14] and the flower number per shoot increased with increasing concentrations of zinc, which is due to significant increase in shoot number that ultimately ended in an individual flower which was reported by Giriraj and Kacha (2014) [4]. The least days for initiation of fruiting (86.77), 50% fruiting (98.00) and completion of fruiting (118.78) were also reported in F_6. So, the plants received with F_6 had maximum fruits per plant (69.14) and yield (10.90 kg/plant).

Table 1: Influence of number of shoots and nutrients on flowering and fruiting parameters in rejuvenated guava

Treatments	Number of days for flowering			Number of flowers		Number of days for fruiting			Number of fruits per plant	Yield (kg/plant)
	Initiation	50 per cent	Completion	Per shoot	Per plant	Initiation	50 per cent	Completion		
Shoots retention (S)										
S_1	71.36	81.17	87.61	19.88	68.67	86.33	97.96	120.22	61.71	9.17
S_2	75.78	86.56	92.06	25.18	75.85	90.53	102.50	123.39	69.28	10.25
S_3	81.40	92.33	98.67	23.16	72.09	96.11	107.56	128.28	65.48	9.23
S.E.M ±	1.53	1.61	1.47	1.05	0.87	1.51	1.47	1.50	0.85	0.23
CD at 5%	4.39	4.64	4.24	NS	2.50	4.34	4.23	4.32	2.45	0.66
Nutrition (F)										
F_1	80.72	91.78	97.78	20.78	67.78	96.22	108.00	130.44	61.02	8.31
F_2	79.22	90.33	95.78	21.63	69.91	94.22	106.44	127.89	63.03	8.81
F_3	76.83	87.22	93.22	22.50	71.89	91.56	103.29	123.44	65.43	9.35
F_4	75.92	85.22	91.33	22.73	73.09	89.44	100.89	122.00	66.52	9.73
F_5	72.67	84.00	91.00	24.11	74.61	87.72	99.41	121.22	67.80	10.20
F_6	71.72	81.56	87.56	24.67	75.93	86.77	98.00	118.78	69.14	10.90
S.E.M ±	2.16	2.28	2.08	1.49	1.23	2.14	2.08	2.12	1.20	0.33
CD at 5%	6.20	6.56	5.99	4.28	3.54	6.14	5.99	6.11	3.46	0.94
Interactions (S x F)										

$S_1 F_1$	76.17	88.00	94.67	18.55	65.67	91.00	102.67	125.33	58.73	8.04
$S_1 F_2$	73.67	86.33	91.33	19.10	66.90	88.67	100.33	122.67	59.70	8.63
$S_1 F_3$	72.17	81.33	88.00	19.50	68.33	87.00	98.67	121.00	61.41	8.93
$S_1 F_4$	70.33	79.00	86.00	19.77	68.77	85.33	97.00	118.67	61.83	9.27
$S_1 F_5$	68.33	77.33	84.00	20.67	70.33	83.50	95.08	118.00	63.47	9.71
$S_1 F_6$	67.50	75.00	81.67	21.67	72.00	82.50	94.00	115.67	65.12	10.41
$S_2 F_1$	79.33	91.33	96.33	23.00	70.67	96.00	107.67	132.00	64.13	8.80
$S_2 F_2$	79.00	90.33	95.33	23.67	72.50	94.00	107.00	128.00	65.82	9.16
$S_2 F_3$	77.33	86.67	91.67	25.33	75.33	92.33	103.86	121.00	68.83	10.09
$S_2 F_4$	76.67	84.67	89.67	25.41	77.13	88.33	99.67	120.67	70.48	10.46
$S_2 F_5$	71.67	84.33	92.33	26.33	79.00	86.67	98.83	119.67	72.45	11.15
$S_2 F_6$	70.67	82.00	87.00	27.33	80.47	85.82	98.00	119.00	73.96	11.87
$S_3 F_1$	86.67	96.00	102.33	20.80	67.00	101.67	113.67	134.00	60.18	8.10
$S_3 F_2$	85.00	94.33	100.67	22.13	70.33	100.00	112.00	133.00	63.58	8.64
$S_3 F_3$	81.00	93.67	100.00	22.67	72.00	95.33	107.33	128.33	66.05	9.03
$S_3 F_4$	80.75	92.00	98.33	23.00	73.38	94.67	106.00	126.67	67.24	9.47
$S_3 F_5$	78.00	90.33	96.67	25.33	74.48	93.00	104.33	126.00	67.48	9.74
$S_3 F_6$	77.00	87.67	94.00	25.00	75.33	92.00	102.00	121.67	68.36	10.42
S.E.M ±	3.74	3.95	3.61	2.58	2.13	3.70	3.61	3.68	2.08	0.57
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Conclusion

Plants with 3 shoots per branch flowers and fruits early but moderately (4 shoots/branch) thinned plants have higher number of flowers per shoot and plant, maximum fruits per plant and yield. Plants received with 100 per cent RDF (200:80:150 NPK g/plant) + (Zn+B+Mg) 0.3 per cent each will take least days for flowering, fruiting and will have maximum number of flowers per shoot and plant, maximum fruits per plant which influences better yield in rejuvenated guava.

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