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Short communication

Winter season crop regulation in Sardar guava

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ABSTRACT

A field experiment was conducted on six year old guava cv. Sardar trees subjected to ten treatments, i.e., T_1- Urea spray 10 % fertilizer grade at 50 % bloom stage and second spray after 10 days of first spray, T_2- Urea spray 15% fertilizer grade at 50 % bloom stage, T_3- NAA @ 1000 ppm, T_4- NAD @ 80 ppm, T_5-Pruning of ¾ length of current season shoot, T_6- Pruning at ½ length of current season shoot, T_7- Bending of upright shoots, T_8- Withheld irrigation with root exposure, T_9- Withheld irrigation and T_{10}-Control. The results showed that vegetative growth parameters (number of newly emerging shoots and leaf area index) were maximum under NAD @ 80 ppm whereas, yield (plant^{-1} and ha^{-1}) was better under NAA at 1000 ppm. In terms of physico-chemical parameters (fruit weight, TSS, ascorbic acid content), bending (T_7) and pruning at ½ length of shoot (T_6) showed its superiority. As far as economics is concerned, higher net return (Rs.1, 10,561.9 ha^{-1}) and B: C ratio (2.82:1) were recorded in Urea 15% fertilizer grade single spray treatment (T_2). Thus, T_2 treatment was economically efficient for avoiding rainy season crop load and registered significantly higher fruit yield as well as satisfactory fruit quality attributes in winter season guava under southern Rajasthan conditions.

Key words: *Psidium guajava*, *Mrig* bahar, pruning, growth regulators.

Guava (*Psidium guajava* L.) is one of the most exquisite and valuable fruits of the tropical and sub tropical climate. It is the fifth important fruit crop at national level after mango, banana, papaya and citrus covering an area of 268.2 thousand hectares with total production of 3667.9 thousand tonnes and productivity of 13.70 t/ha in India (Anonymous, 4). In Rajasthan, guava is third important fruit crop after citrus and mango. It covers an area of 4332 hectares with an annual production of 55130 metric tonnes (Anonymous, 3).

The major guava growing pockets in Rajasthan are Swaimadhopur, Kota, Bundi, Ajmer, Udaipur and Chittorgarh districts. In Rajasthan, guava bears during rainy (*ambe bahar* - February to March flowering and fruit ripens in July – August) and winter (*mrig bahar* – June to July flowering and fruit ripens from October to December) season (Sarolia *et al*., 11).

Further, fruits during rainy season (*ambe bahar*) are invariably poor in quality and the fruits are rough, insipid, watery and less nutritive. Maximum fruits get infected with anthracnose or infested with fruit fly. Therefore, winter season is considered as the best fruiting season because of lower infestation of fruit fly, high sale price good quality of fruits as well as more profitability than rainy season crop (Sarolia *et al*., 10). In order to avoid heavy crop load during rainy season, various means (cultural and agro-chemicals) are adopted for crop regulation in guava for getting quantum and quality yield. Keeping this in view and to find out viable crop regulation mean (s) for commercial exploitation of winter season crop and avoid rainy season crop load the present experiment was carried out.

A field experiment was conducted on 6 m x 6m spaced, six year old guava cv. Sardar trees during 2010-15 at ARS, Udaipur with ten treatments i.e., T_1- Urea spray 10 % fertilizer grade at 50 % bloom stage and second spray after 10 days of first spray, T_2- Urea spray 15% fertilizer grade at 50 % bloom stage, T_3- NAA @ 1000 ppm, T_4- NAD @ 80 ppm, T_5-Pruning of ¾ length of current season shoot, T_6- Pruning at ½ length of current season shoot, T_7- Bending of upright shoot, T_8- Withheld irrigation with root exposure, T_9- Withheld of irrigation and T_{10}-Control. These treatments were applied under randomized block design with quadruple replications during late March-April (T_8 & T_9), mid April-may (T_1 to T_6) and August (T_7) by adopting uniform cultural schedule during the investigation. Growth (new shoots emerged branch^{-1}, leaf area index), flowering (days required for flowering & fruit retention), yield (plant^{-1} & ha^{-1}), quality (fruit weight, TSS & ascorbic acid) attributes were observed and analyzed as per standard methodology (A.O.A.C., 1). Specific parameters like Leaf area index was taken with the help of canopy analyzer (LP-80, LAI meter) and yield plant^{-1} was calculated by harvesting physiologically mature fruits periodically from each treatment separately and the weight was recorded with the help of electronic balance. The yield of fruits per hectare was calculated by multiplying the yield

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of fruit per plant with number of plants per hectare i.e. 278 plants per hectare. Economics included total cost (general + treatment), returns (gross + net) and B: C ratio by using formula net returns/ total cost. The experimental data were analyzed statistically following standard methodology as outlined by Fisher (7).

The results indicated that all the treatments effectively discouraged production of guava during rainy season and led to significant (p=0.05) increase in production during winter season.

NAD (T_4) treatment gave higher number of new shoots (4.60) and LAI (1.90) closely followed by ¾ (T_5) and ½ (T_6) pruning intensity level and minimum in control (Table 1). The increase in number of new shoots branch^{-1} under NAD and pruning treatments probably might be attributed to narrow C: N ratio of plant that induced vegetative flush in the tree and resulted in vigorous growth of the plant (Jadhav *et al.*, 8 & Agnihotri *et al.*, 2).

Maximum fruit retention (69.30 %) and minimum days (26.88 days) required for flowering after treatment application were recorded in the NAA @ 1000 ppm treatment (T_3). It might be due to reduced fruit drop, so maximum retention was observed (Dubey *et al.*, 5) and foliar application facilitates its immediate absorption which increased the endogenous auxin level (Singh *et al.*, 14).

Markedly enhanced fruit yield plant^{-1} (54.50 kg) and estimated yield ha^{-1} (15.15 t) in the NAA @ 1000 ppm treatment (T_3) is probably due to residual effect of NAA on plants that resulted in higher fruit retention and subsequent yield (Table 2). Singh *et al*. (12) also supported the present results with the observed that highest deblossoming of guava during rainy season and the highest yield during the winter season with spray of NAA.

Next best treatment with respect to yield parameters was T_2 (single spray of 15 % fertilizer grade urea) and it was minimum under control (33.61 kg tree^{-1} & 9.34 tha^{-1}). Similarly, higher fruit weight (136.50g) was recorded in ¾ pruning (T_5) and bending (T_7) over chemical treatments. The present results are in agreement with the findings of Singh and Singh (13). They observed that the total nitrogen derived from guava foliage was proportionate to the quantity of urea applied and this might be due to accentuation of more NH_4^+-N in the leaves making additional nitrogen available to trees resulting in increased yield during the winter season. Here, double spray of 10 per cent (T_1) was inferior over single spray 15 per cent urea (T_2); it might be due to phytotoxic influence of higher concentration of urea on guava foliage which caused burning and defoliation thereby resulting in low accumulation of photosynthates responsible for fruit growth and development. Similarly, higher fruit weight recorded in ¾ pruning (136.50g) and bending treatments (135.58 g) was probably due to poor crop load in ¾ pruning and bending of shoot, which restricted the movement of carbohydrates (Kumawat *et al*., 6).

Better quality of fruits with respect to TSS (13.20°B) and ascorbic acid (177 mg/100g) contents was recorded under T_6 (½ length current shoot), which was closely followed by T_7 (Bending) treatment. However, treatments T_2, T_5, T_6 and T_7 were statistically at par. The quality fruits of winter season guava could be harvested from the tree imposed with pruning of ½ length current shoot (T_6) and bending (T_7) over rest of the treatments, probably because both the treatments opened the tree canopy facilitating penetration and utilization of optimum solar light (Sahay and Kumar, 9) and bending additionally restricted the movement of carbohydrates at repository site (Kumawat *et al*., 6).

Table 1. Effect of crop regulation treatments on growth and flowering of guava.

Treatments	New shoots/branch	Leaf area index	Days required for flowering	Fruit retention (%)
T_1	3.33	1.82	32.09	53.64
T_2	3.57	1.86	30.22	64.25
T_3	3.50	1.87	26.88	69.30
T_4	4.60	1.90	28.40	58.70
T_5	4.52	1.89	32.17	68.60
T_6	4.50	1.88	30.28	62.30
T_7	3.23	1.84	31.04	67.85
T_8	2.99	1.82	29.52	59.90
T_9	2.91	1.80	30.02	59.86
T_{10}	2.86	1.77	37.13	45.74
SEm ±	0.045	0.023	0.30	2.06
CD (P=0.05)	0.129	0.065	0.83	6.06

Table 2. Effect of crop regulation treatments on yield and quality of guava.

Treatments	Fruit weight (g)	Yield plant^{-1} (kg)	Yield ha^{-1} (t)	TSS (°B)	Ascorbic acid (mg/100g)	Visual observations
T_1	134.23	49.87	13.86	12.53	173.19	Tree showed residue effect in term of phyto toxicity
T_2	135.12	53.86	14.97	13.00	176.72	Satisfactory & economic
T_3	133.24	54.50	15.15	12.60	173.21.	Maximum yield & cost
T_4	133.75	50.73	14.10	12.40	171.50	Satisfactory
T_5	136.50	33.78	9.41	12.93	177.00	Due to heavy pruning, followed year gave better yield
T_6	130.78	39.30	10.93	13.20	178.09	Satisfactory yield with good quality fruits
T_7	135.58	40.13	11.16	13.00	176.50	Most suited for upright growing branches.
T_8	120.50	42.82	11.90	12.02	167.60	Improved fruit size and yield over control
T_9	120.64	42.93	11.93	12.00	165.25	
T_{10}	102.55	33.61	9.34	11.73	160.50	Small size fruit and poor yield
SEm ±	1.652	0.624	0.167	0.124	1.675	
CD (P=0.05)	4.706	1.776	0.475	0.354	4.772	

As is evident from Table 3, the general cost of guava cultivation was Rs. 37,181 per hectare including labour cost, cost of various inputs and over head costs. Treatment-wise additional cost included cost of agrochemicals and labour for pruning, bending, spraying, etc for the treatment application. The gross returns from sale of guava fruits were calculated at an average price of Rs. 10000 per tonne. The net profits from cultivation under different treatments were worked out after subtracting the cost of cultivation from gross returns. The data revealed that the maximum net profit of Rs. 1,10,561.9 ha^{-1} was obtained under the treatment T_2 followed by T_3, whereas the minimum net profit was in control (Rs. 56,219 ha^{-1}). As far as B: C ratio is concerned treatment T_2 gave B: C ratio of which means the gain of Rs. 2.82 per rupee of the cost incurred. Therefore, it may be inferred that T_2 was the most economical treatment because it gave the highest net returns and B: C ratio (2.82:1).

In order to study the degree of association between fruit yield with other independent parameters, it was observed that fruit yield was positively (with LAI,

Table 3. Economics of crop regulation treatments of guava.

Treatments	Treatment cost (Rs.)	Total cost ha^{-1} (Rs.)	Yield ha^{-1} (t)	Gross returns (Rs.)	Net returns (Rs.)	B:C
T_1	3683.50	40864.50	13.86	138600.0	97735.5	2.39
T_2	1957.12	39138.12	14.97	149700.0	110561.9	2.82
T_3	4250.50	41431.50	15.15	151500.0	110068.5	2.65
T_4	4766.00	41947.00	14.10	141000.0	99053.0	2.36
T_5	1668.00	38849.00	9.41	94100.0	55251.0	1.42
T_6	1668.00	38849.00	10.93	109300.0	70451.0	1.81
T_7	2502.00	39683.00	11.16	111600.0	71917.0	1.81
T_8	3500.00	40681.00	11.90	119000.0	78619.0	1.93
T_9	3000.00	40181.00	11.93	119300.0	79119.0	1.97
T_{10}	-	37181.00	9.34	93400.0	56219.0	1.51
SEm ±			3.734	3360.77	3360.77	0.086
CD (P=0.05)			11.256	10130.45	10130.45	0.259

*Sale price of guava per tonne was Rs. 10,000

Table 4. Response study of fruit yield vs. various dependent variables of guava.

S. No.	Dependent variable (y)	Independent (x)	r	R^2	Efficiency ratio ΔR^2
1	Yield (t/ha)	LAI	0.37	0.13	13.54
2	Yield (t/ha)	Days for flowering	-0.69*	0.47	47.43
3	Yield (t/ha)	Fruit weight	0.47	0.22	22.20
4	Yield (t/ha)	TSS	0.31	0.09	9.40
5	Yield (t/ha)	Ascorbic acid	0.37	0.15	14.94
6	Yield (t/ha)	Net returns	0.99**	0.99	99.78
7	Yield (t/ha)	B:C	0.97**	0.97	97.33

fruit weight TSS & vitamin C) and significantly (with economics) correlated, whereas days for flowering significantly and negatively correlated with fruit yield. Among the parameters economics (r=>0.95) had the maximum positive effect on fruit yield followed by fruit weight (r=0.47) (Table 4).

The describe relationship y=a+bx between fruit yield and LAI, days for flowering, fruit weight, TSS, Vitamin C and economics alone were responsible for 13.54, 47.43, 22.2, 9.4, 14.94 and >95 per cent, respectively predictability of fruit yield. It means, 22.2 per cent variation in fruit yield is due to fruit weight.

Finally, it can be concluded that single spray of 15 per cent fertilizer grade urea (April- May) at 50 per cent bloom stage (T_2) was technically and economically efficient. Hence, this treatment may be used effectively for commercial crop regulation of guava cv. Sardar.

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