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RESEARCH ARTICLE :

Effect of integrated nutrient management on flowering, fruit set, fruit growth and yield of guava (*Psidium guajava* L.) cv. ALLAHABAD SAFEDA

■ **SRINIVAS MAMINDLA AND V. M. PRASAD**

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SUMMARY : An experiment was undertaken at the central field of Department of Horticulture, Allahabad school of Agriculture, SHIATS, Allahabad (U.P.) during 2012(July) – 2013(January) with the entitled "Effect of Integrated Nutrient Management on Flowering, Fruit set, Fruit growth and Yield of Guava (*Psidium guajava* L.) cv.ALLAHABAD SAFEDA". The experiment was laid out in Randomized Block Design (RBD) with 10 treatments and 3 replications. For the investigation, different sources of organic and inorganic plant nutrients *viz.*, FYM, *Neem cake*, Vermicompost, Urea, DAP, MOP and Micro nutrients (B and Zn) in different combinations were used. The result was revealed that investigation of organic manures and inorganic fertilizers along with micro nutrients was more effective in increasing fruit growth, yield and quality of guava than the inorganic fertilizers alone. Among the various combinations, treatment T_5 (50% Recommended dose of NPK (300g N: 100g P_2O_5:200g K_2O Per tree) + 15 kg FYM + 5 kg *Neem* cake + Micro nutrients (0.3% B and 0.3% Zn)) was found the best over all the treatments in respect to physical parameters like days to first flower initiation (24.67 days), fruit yield per tree (62.01 kg) and fruit yield per hectare (9.67 tonnes), respectively.

KEY WORDS :
Organic manures, inorganic fertilizers, Flowering, Fruit growth, Yield, Guava

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BACKGROUND AND OBJECTIVES

Guava (*Psidium guajava* L.), the apple of the tropics is one of the most common fruit crop in India. It is the fourth most important fruit crop after mango, banana and citrus in the country and covers an area of about 2, 05,000 ha with production of around 24, 62,000 MT (metric tonnes) and productivity about 12.0 MT ha^{-1} [Indian horticulture data base, 2011]. It is quite hardy and remunerative crop. But the yield and quality of fruit is poor due to either no manuring or unbalanced manuring. Fertilizer experiment was conducted in India showed that guava has given high response to inorganic fertilizers along with organic manures. The integration of organic and inorganic fertilizers was more effective in increasing the fruit set (%), fruit growth and yield of guava fruits than the inorganic fertilizers alone. It is also helpful to reduce

the inorganic fertilizer requirement, restore the organic matter in soil and improve the physical, chemical and biological properties of soil. Similarly, application of zinc and boron might have cause rapid synthesis of protein and translocation of carbohydrates which ultimately led to increase fruit weight, diameter yield and quality of guava fruits. Hence, the present investigation was planned to chalk out nutritional schedule with a view to improve the fruit set (%), fruit growth and yield of guava.

RESOURCES AND METHODS

An experiment was carried out at central field of guava orchard, Department of Horticulture, SHIATS, Allahabad on 15 years old guava trees cv. ALLAHABAD SAFEDA during the year of 2012(July)- 2013(January). The trees were planted at 8×8 m distance and maintained under uniform cultural practices. The experiment was laid out in Randomized Block Design with 10 treatments and 3 replications. The soil of the experiment site was sandy loam, with a pH –6.9, organic carbon- 1.4% and nitrogen- 303 kg/ha, phosphorus- 12.6 kg/ha, potassium- 122 kg/ha. The various treatments were used in this study and the details about the treatments were given below: T_0 – Control, T_1 – RDF (600N:200P_2O_5:400K_2O g), T_2 – (75% RDF+ 25 kg FYM), T_3 – (75% RDF + 25kg FYM + Micronutrients *i.e.* B (0.3%), Zn (0.3%), T_4 – (50% RDF + 15kg FYM + 3kg *Neem* cake), T_5 – (50% RDF + 15kg FYM + 3kg *Neem* cake + Micronutrients *i.e.* B (0.3%), Zn (0.3%), T_6 – (50% RDF + 15kg FYM + 6kg Vermicompost), T_7 – (50% RDF + 15kg FYM + 6kg Vermicompost + Micronutrients *i.e.* B (0.3%), Zn (0.3%), T_8 - (25% RDF + 15kg FYM + 3kg *Neem* cake + 6kg Vermicompost), T_9 (25% RDF + 15kg FYM + 3kg *Neem* cake + 6kg Vermicompost + Micronutrients *i.e.* B (0.3%), Zn (0.3%). At the time of application of fertilizers, a trench of 30 cm width and depth, 1 m away from trunk of the tree was prepared. All the fertilizers were applied in trench and covered with the soil at pre flowering stage. Here, NPK were applied through urea, DAP, MOP, respectively and the micronutrients *i.e.* zinc (0.3%) through zinc sulphate and boron (0.3%) through boric acid were sprayed with the help of foot and pedal pump sprayer at the time of fruit setting stage and 1month after fruit set. The observations were recorded on days to first flower initiation , number of flowers per tree, % of fruit set, number of fruits per tree, fruit weight (g), fruit diameter (cm), specific gravity (w/v), fruit yield per tree (kg), fruit yield per hectare (tonnes).

OBSERVATIONS AND ANALYSIS

It is an evident from the data (Table 1 and 2) that physical parameters and yield were significantly influenced by the application of different sources of organic and inorganic plant nutrients.

Physical parameters :

Days to first flower initiatation:

The results revealed that the minimum days to first flower initiation (24.67) was recorded in the treatment T_5. It may be due to the supply of the nutrients to the

Table 1: Effect of integrated nutrient management on flowering, fruit set, fruit growth and yield of guava (*Psidium guajava* L.) cv. ALLAHABAD SAFEDA

Treat. No.	Days to first flower initiation	Number of flowers per tree	% of fruit set	Number of fruits per tree	Fruit weight (g)
T_0	30.00	269.33	57.08	153.67	126.00
T_1	28.33	386.67	59.16	227.33	154.55
T_2	27.33	389.00	63.97	239.00	143.55
T_3	26.00	336.00	62.86	209.33	163.22
T_4	28.00	566.67	59.56	335.33	166.77
T_5	24.67	447.33	70.12	314.33	197.55
T_6	28.67	341.67	69.85	235.67	202.99
T_7	25.67	419.67	60.26	252.33	185.22
T_8	27.67	377.00	65.10	245.00	140.22
T_9	25.67	331.33	72.99	241.33	198.77
S.E.±	1.269	45.291	3.910	35.025	2.776
C.D. (P =0.05)	2.690	96.017	8.290	74.253	5.884

tree as per the requirement of the crop which was induced first flower initiation significantly varied from other treatments.

Number of flowers per tree :

The maximum number of flowers (566.67) was recorded with the treatment T_4 which was on par with the treatment T_5 and the lowest number of flowers was recorded in untreated control (T_0). The maximum number of flowers was recorded mainly due to better vegetative growth and improvement in the physiological condition which caused higher % of flowering. The prolonged availability of nutrients during the growth period from organic manures might have enhanced the number of flowers. The results are agreement with the finding of Singh *et al*. (2007).

Fruit set (%) :

There has been a significant effect of different sources of organic and inorganic plant nutrients on the % of fruit set (Table 1). The highest fruit set % (72.99%) was recorded in the treatment T_9. While the lowest fruit set % (57.08%) was recorded in control. The fruit set % enhanced might be due to retention capacity of nutrients to a prolonged period from organic manures and its balanced availability when combination with inorganic fertilizers might have resulted in higher % of fruit set. The result is similar to the finding of Singh *et al*. (2007).

Number of fruits per tree :

The highest number of fruits (335.33) was recorded in treatment T_4. In contrast, yield was reduced because of less fruit weight and diameter was recorded in this treatment T_4 (Table 1) compare to other treatment combinations like T_6, T_9, T_5, T_7. The results are close conformity with the findings of Dhomane *et al*. (2011).

Fruit weight :

However, maximum fruit weight (202.99 g) was recorded in treatment T_6 which was on par the treatment T_9 (198.77 g) and T_5 (197.55 g). It might be due to this treatment T_6 had less number of fruits compare to treatment T_5 or combination of treatment T_6 supplied the nutrients as per the requirement of the crop. But in treatment T_5 both the number of fruits and fruit weight increased, respectively. It might be due to application of micro nutrients *i.e.* zinc (0.3%) and boron (0.3%) have caused rapid synthesis of protein and translocation of carbohydrates which ultimately led to increase fruit weight and also number of fruits per tree increased might be due to more fruit retention on the tree and less fruit drop because of increase in internal auxin levels through zinc mediated biosynthesis of tryptophan. The results are in conformity with the finding of Katiyar *et al*. (2008) and Athani *et al*. (2009).

Fruit diameter :

The data presented in Table 1. It was observed that treatment T_9 resulted in maximum fruit length (7.81 cm) and treatment T_6 resulted in maximum fruit width (8.53 cm), while minimum fruit length and width were recorded in control. The higher length of fruit due to combined

Table 2: Effect of integrated nutrient management on flowering, fruit set, fruit growth and yield of guava (*Psidium guajava* L.) cv. ALLAHABAD SAFEDA

Treat. No.	Polar diameter (cm)	Radial diameter (cm)	Specific gravity (w/v)	Fruit yield (kg/tree)	Fruit yield (t/ha)
T_0	5.57	6.07	0.59	19.32	3.01
T_1	6.02	6.52	0.69	35.24	5.49
T_2	5.70	6.30	0.66	34.30	5.35
T_3	6.14	6.84	0.72	34.08	5.31
T_4	6.79	7.15	0.67	56.01	8.73
T_5	7.73	8.25	0.79	62.01	9.67
T_6	7.59	8.53	0.82	47.75	7.44
T_7	7.15	8.05	0.78	46.76	7.29
T_8	5.37	6.17	0.65	34.43	5.37
T_9	7.82	8.42	0.81	48.06	7.49
S.E.±	0.083	0.069	0.086	8.079	1.261
C. D. (P = 0.05)	0.175	0.146	0.182	17.128	2.672

application of zinc and boron may be attributed to their stimulatory effect on plant metabolism because boron plays key role in cell division and elongation, whereas, zinc is an essential micronutrient for auxins and protein synthesis, seed production and proper maturity of fruit thereby effecting increase in the polar diameter of fruit. The results are agreement with the finding of Katiyar *et al.* (2008) and Athani *et al*. (2009).

Yield :

It is revealed from the data given in Table 2, that highest fruit yield per tree (62.01 kg) and fruit yield per hectare (9.67 tonnes) were recorded in the trees treated with 50% recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + Micro nutrients *i.e.* Zn and B (T_5). The improvement in the yield and yield components may be attributed to integrated use of organic and inorganic plant nutrients along with micronutrients which influenced the plant metabolism favorably, individually and collectively increasing the photosynthesis which ultimately improved the yield and quality parameters.

Neem cake is rich in plant nutrients and in addition to that it contains alkaloids like nimbin and nimbidin, which have nitrification inhibiting properties and releases nitrogen slowly. Thus, apart from the nutrient content in the *Neem* cake, the retention capacity of nutrients to a prolonged period and its balanced availability might have resulted in producing better yield. The results are agreement with the finding of Maity *et al*. (2006) and Priyaawasthi and Shantlal (2009).

Conclusion :

From the present investigation it is concluded that among the different treatment combinations the treatment T_5 (50% recommended dose of NPK + 15 kg FYM + 3 kg *Neem* cake + Micro nutrients *i.e.* Zn (0.3%) and B (0.3%) was superior in respect to days to first flower initiation, fruit growth and yield of guava fruits cv. ALLAHABAD SAFEDA.

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RESEARCH ARTICLE :

Preliminary study on germination of pre-treated seed of red sanders under nursery conditions from Tamil Nadu

■ **K.P. VIJAYALAKSHMI AND P.R. RENGANAYAKI**

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SUMMARY : The field experiment was carried out during 2015-16 at Forest College and Research Institute, Mettupalayam, Tamil Nadu, India to study the effect of pre-treated seed of red sanders under nursery conditions. The results indicated that there was significant effect of Alternate Wetting and Drying (48h) over control. The significantly early (8 days) and maximum (73 %) germination and speed of germination were recorded in treatment having Alternate Wetting and Drying (48h). The seedling height (19.77 cm), dry weight (0.24 g) were also higher with treatment Alternate Wetting and Drying (48h).

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KEY WORDS :
Mechanical clipping, Cow dung slurry, Speed of germination, Vigour index

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BACKGROUND AND OBJECTIVES

A red sander (*Pterocarpus santalinus*) is an evergreen tree species grown under semi dry climates in well -drained lateritic soils. It is an endemic and endangered, largely confined to the southern portion of the Eastern Ghats, Andhra Pradesh, India (Shilpa *et al*., 2008), some pockets of Karnataka and Tamil Nadu ; cultivated in Maharashtra, Odisha and West Bengal and introduced in Sri Lanka . The reddish and fragrant heartwood has range of medicinal, pharmaceutical, industrial and timber value and thus economically placed in the same range as tusk and amber. Conventional vegetative propagation techniques such as grafting and air-layering have limitations in large-scale multiplication of this species and rooting of cutting was also found to be poor. Tissue culture has proved to be a promising technique for conservation and large scale multiplication of several woody species. However, the members of Fabaceae have been difficult to culture *in vitro* owing to their recalcitrant nature, roots were robust and vigorous in air layers compared to stem cuttings, but the rate of manipulation is comparatively low and not enough to transplant in the nursery and main field. Based on the above reasons, the multiplication of the species largely depends on seed. Germination of red sanders seed is often very difficult

because of a hard seed coat coupled with poor viability (Dayanand and Lohidas, 1988). Seed possessed with dormancy up to six months to one year, type of dormancy has not yet been elucidated. Presence of dormancy cause prolonged germination. Considering the commercial importance of *Pterocarpus santalinus* and problems faced in seed propagation, to generate scientific information on pod and seed factors responsible for poor germination and treatments to enhance the germination by overcoming the obstacles, the present study was carried out.

RESOURCES AND METHODS

The present study was carried out during 2015-16 at Forest College and Research Institute, Mettupalayam, Tamil Nadu, India.

Seeds of *Pterocarpus santalinus* were collected during June, 2015 from Vellore, Tamil Nadu and subjected to various pre-sowing treatments, With four replication 400 seeds were used for each treatment as shown below.

Treatment details :

Control (T_0) *:*

Mechanical clipping of pod (T_1):

Hard woody pod was damaged at the distal end using wire cutter/secateurs and subjected to germination test.

Cow dung slurry (T_2) :

Pods were mixed with cow dung slurry (1:2 ratio of water and cow dung) and kept for 24h and tested for germination in nursery.

Water soaking for 24h (T_3) :

Pods were soaked in cold water for 24h duration and subjected to germination test.

Water soaking for 48h (T_4) :

Pods were soaked in cold water for 48h duration and subjected to germination test.

Alternate wetting and drying for 24h (*AWD*) (T_5) :

Pods were subjected to two cycles of 6h of wetting and 6 h of drying and subjected to germination test.

Alternate wetting and drying for 48h (*AWD*) (T_6) :

Pods were subjected to two cycles of 12h of wetting and 12h of drying and subjected to germination test.

Observations recorded :

Days to initial germination :

The nursery bed was observed daily, for seedling emergence. The day on which the first seedling emerged was expressed as days to initial germination.

Days to final germination :

The number of days on which the last seedling emerged was recorded and expressed as days to final germination.

Speed of germination :

Speed of germination was calculated by the following formula:

Speed of germination= n1/d1+n2/d2+n3/d3+---------

where, n = Number of germinated seeds;

d= Number of days.

Germination per cent :

The number of normal seedlings produced in each replication(4 replication/25 pods) was counted and average was expressed in per cent.

Germination percentage = 100.

Seedling length :

All normal seedlings of each treatment were measured for length from root tip to shoot tip and the average was expressed in cm.

Dry weight :

All normal seedlings were dried under shade for 24 h and then dried in hot air oven maintained at 85 ± 1°C for 48 h. It was cooled in a desiccator for 30 minutes and weighed. The values were expressed as 'g seedlings^{-1}'.

Vigour index :

Vigour index (VI) was computed using the following formula and expressed as whole number.

VI = Germination percentage x dry weight (g/ seedling).

Statistical analysis :

Result data (in per cent) were transformed to arcsine values before statistical analysis in order to unify the variance of the data (Ansari *et al*., 2012). The data were

then analyzed by the 'F' test for significance at 0.05 level by using statistical software AGRESS.

OBSERVATIONS AND ANALYSIS

Different treatments had a significant and positive effect on improving and hastening seed germination the increment was low in mechanical clipping(47%), cow dung slurry 24h (50%), water soaking 24h (48%) and alternate wetting and drying 24h (61%), but pronounced effect in other two *i.e.* alternate wetting and drying 48h(52%) and water soaking 48h (73%) treatments. Different set of treatments might have their own effect either on weakening of hard seed coat, or leaching of water soluble inhibitors. Seed germination test conducted in the present study revealed that resulted in poor germination percentage even after a period of 57 days with a value of 33 per cent (Table 1).

Mechanical clipping of pod make a point of water entry inside seed, would allowed the seed to start the germination process, which resulted in little increased and early germination compared to control. Seed possessed with physical dormancy due to hard seed coat as in the case of *Delonix regia* .The enhanced and more uniform germination with higher seedling vigour of the cow dung slurry treatment may be the result of corrosion of pod coat by the week acids, digestion of thin and strong veins by the microbes present in cow dung, both together might have resulted in the opening of pores, supports or aids in water entry to initiate pre germination metabolic events; entry of growth stimulants present in cow dung and adequate water through the opened pores made the seeds to perform positively.The results are supported by similar studies reported by Anand *et al.* (2012).

Seed germination is a complex process in tropical forest species due to known and unknown factors. Consequences of germination of the species could be

Table 1 : Effect of treatment on seed germination characteristics

Treatments	Days to initiate germination	Days to final germination	Speed of germination	Germination %
T_0	13.00	57.00	00.21	33(35.06)
T_1	12.25	48.50	00.31	47(43.28)
T_2	14.25	28.75	00.78	50(45.00)
T_3	09.25	33.00	00.46	48(43.85)
T_4	08.75	28.50	00.53	52(46.14)
T_5	08.00	20.25	03.36	61(51.35)
T_6	08.00	16.00	04.79	73(58.69)
Mean	10.50	33.14	1.49	52(46.19)
S.E.±	0.57	1.46	0.04	1.02
C.D. (P ≤0.05)	1.16	2.96	0.08	2.07

T_0- Control T_1- Mechanical clipping of pod, T_2- Cow dung slurry coating (48h), T_3- Water soaking (24h), T_4- Water soaking (48h), T_5- Alternate wetting and drying (24h) , T_6- Alternate wetting and drying (48h) *Figures in parentheses indicate arc-sine value

Table 2: Effect of treatment on seedling characteristics

Treatments	Seedling length (cm)	Dry weight (g)	Vigour index	Survival (%)
T_0	11.27	0.18	06.08	90.75
T_1	11.80	0.19	09.65	91.00
T_2	17.27	0.17	08.40	89.25
T_3	14.32	0.11	05.75	91.25
T_4	16.67	0.20	10.68	93.75
T_5	14.95	0.19	11.71	85.75
T_6	19.77	0.24	17.37	90.25
Mean	15.15	0.18	9.95	90.29
S.E.±	0.42	0.01	1.07	0.59
C.D. (P ≤0.05)	0.88	0.04	2.17	1.20

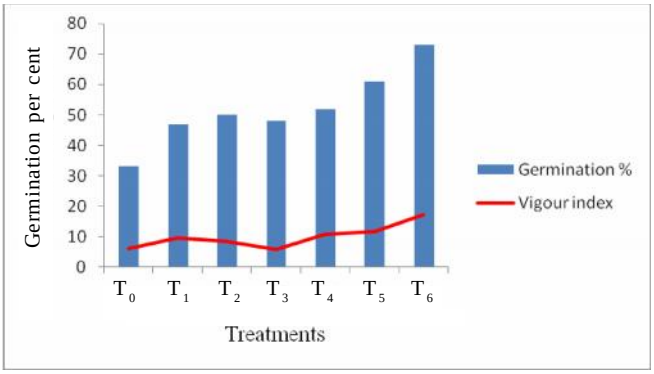

Fig. 1: Effect of different treatment on germination percentage and vigour index in red sanders

influenced by both environment and seed factor. In the present investigation alternate wetting and drying able to increase germination (73%) , where seeds germinated with a higher seedling length (19.77cm), vigour index (17.37), dry weight (00.24g) and survival percentage (90.29) within a shorter duration of 16 days (Table 2). The reason behind the treatmental effect might be expansion of cells during wetting and contraction during drying which resulted in weathering of pod coat, facilitated penetration of required quantity of water inside the pod and accelerated the initial process of germination *viz*., breakdown of food material and synthesis of enzymes, as quoted by Walter *et al*. (1981). Whereas in case of water soaking the gradual softening of seed coat facilitated the improvement , the results are in line with Lozumi *et al.* (2016) in *Acacia nilotica.*

In the present study carried out to find best germination improvement treatment for red sanders, revealed that subjecting the of pods to alternate wetting and drying for 48h (73%) would be the best one among six tried treatment.

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