



EFFECT OF VARIETY AND POULTRY MANURE ON THE GROWTH OF PAWPAW (*Carica Papaya*) SEEDLINGS

¹Babagana, B. M*, ²Dawaki, J. A, ²Fagam, A. S., ²Shuaibu, Y. M. and ¹Yusuf., Z. A.

¹Department of Crop Science, Federal University of Agriculture, Zuru, Kebbi State

²Department of Crop Production, Abubakar Tafawa Balewa University,
Bauchi, Bauchi State, Nigeria

*Corresponding Author's email: bashirbabagana@gmail.com,

GSM: 07030505391

ABSTRACT

A field experiment to determine the effect of variety and poultry manure on the growth of pawpaw seedlings was conducted during 2023 and 2024 dry seasons at Tafawa Balewa Road, Federal Low-cost Housing Estate Bauchi, Bauchi State, Nigeria. The treatments consisted of five Poultry manure levels (0.0kg, 0.2kg, 0.4kg, 0.6kg and 0.8kg/pot) and two varieties of papaya (Calina IPB9 True Dwarf and Sun Grads) which were factorially combined and arranged in a randomized complete block design (RCBD) with three replications. The results revealed that the treatments significantly ($P \leq 0.05$) affected plant height with poultry manure rate of 0.8kg/pot given the tallest plants throughout the study period. The result further showed a significant ($P \leq 0.05$) effect of the treatments on number of leaves where poultry manure rate of 0.8kg/pot proved to be better than the other rates used. A significant effect ($P \leq 0.05$) was recorded on stem girth and number of nodes with poultry manure rate of 0.8kg/pot taken the lead throughout the study period. Furthermore, there was a significant ($P \leq 0.05$) effect in moisture stress where poultry manure level of 0.2kg/pot showed higher remaining leaves (RML) and higher dry weight than the other treatments considered. Variety on the other hand, except on plant height in 2023 where sun grads proved to be statistically ($P \leq 0.05$) better, no significant ($P \leq 0.05$) difference was observed throughout the study period. The application of cured poultry manure enhanced growth performance and resistance to moisture stress of the considered papaya seedlings. Based on the result of this findings, application of poultry manure to growing pawpaw seedlings at the rate of 0.8 kg/pot is recommended in the study area. Trials with other organic manure as a source of nutrients are therefore recommended.

Keywords: Variety, Organic, Manure, Papaya, Seedlings

INTRODUCTION

Papaya (*Carica papaya* L.) is considered one of the most important fruit crops produced in tropical and subtropical regions (Lima *et al.*, 2016). Though preferably consumed in its natural state, industrialization processes enable its use in the food, textile, pharmaceutical and animal feed industries. The main papaya-producing countries are India, Brazil and Nigeria, which represent 64% of the world's papaya production (EMBRAPA, 2018). In 2018, Brazil had a total output of 1,060,392 t of fruit, distributed across 27,000 ha of cultivated area (IBGE, 2018). Seedling production is one of the most important stages in papaya growing. The substrate and the volume of containers influence seedling formation, providing appropriate conditions for germination and root system growth (Mesquita *et al.*, 2012). In this sense, the choice of a substrate that meets the nutritional and physical requirements of seedlings, as well as is accessible to the producer, is directly linked to the success of the crop (Siqueira, *et al.*, 2020). Thus, low-cost alternative materials that can be



used in the constitution of new substrates have been sought, e.g., agricultural and industrial wastes. With the use of these materials, costs can be reduced and seedling quality enhanced. Organic manure represents a strategy for improving plant growth conditions, as its properties increase water and nutrient retention in the soil and improve plant productivity, in addition to bringing benefits to the environment. Calina Papaya is a native Indonesian fruit. This variety is the result of the breeding of IPB University researchers. This papaya is widely planted by farmers in various regions throughout Indonesia because of its multiple advantages and high market demand. Small papaya with an average weight of 1.3 kilograms per fruit sold in supermarkets, labelled as "California papaya". This papaya has been exported to foreign countries including Malaysia and Singapore (IPBU, 2018). The thing that makes Calina papaya favored by consumers and dominates the fruit market is its sweet taste, thick and soft meat, unprocessed, red in color, and not emitting a distinctive papaya aroma. In addition, the fruit is not too large and can be spent in a single meal, so there is no need to bother storing the cut papaya in the refrigerator (IPBU, 2018).

MATERIAL AND METHODS

Experimental Site

A field experiment was conducted during 2023 and 2024 dry season at Tafawa Balewa Road, Federal Low-cost housing Estate Bauchi, located at approximately 10° 26' latitude and longitude of 9° 48' 42E and about 586 meters above sea level, in the Northern Guinea Savanna Agro-ecological zone of Nigeria.

Treatments and Experimental Design

The treatments consisted of five poultry manure levels (0.0kg, 0.2kg, 0.4kg, 0.6kg and 0.8kg) and two varieties of papaya seedlings, factorially combined to give 10 treatments and arranged in a randomized complete block design (RCBD) with three replications. The land was demarcated into three replicates and each replicate was divided into 10 plots measuring 1m×1m. This gave a total of 30 plots. A path measuring 1m was left between replication and 0.5m between plots.

Experiment Materials and their Sources

Calina IPB9 True dwarf and Sun grads papaya, these varieties was bought from Jos Plateau State through a nursery gardener, Poultry Manure was collected from a poultry house at Bauchi State, five poultry manure levels 0.0kg, 0.2kg, 0.4kg, 0.6kg and 0.8kg were used. All other good agronomic practices for production of papaya had been adhered throughout the period of the experiment. Thirty (30) seedlings of papaya were used during the experiment. During the experiment poultry manure levels were applied twice, first dose at 4WAT (Four Weeks After Treatment) while the second dose was applied 6WAT (Six Weeks After Treatment) this was done because of measuring the moisture stress at the end of the experiment and the experiment takes three months.

Data Collection

Plant height

The Plant height of papaya seedling was measured at 2, 4, 6, 8, 10 and 12 weeks interval after treatment from the ground level to the tips of the leaf using a standard meter ruler.

Number leaves

The Number of Leaf was taken at 2, 4, 6, 8, 10 and 12 weeks after treatment by counting.



Number of nodes

The Number of node was taken at 2, 4, 6, 8, 10 and 12 Weeks after treatment by counting.

Stem girth

The Stem girth was measured at 2, 4, 6, 8, 10 and 12 Weeks after treatment with Vernier caliper.

Data Analysis

All data collected were subjected to statistical analysis of variance (ANOVA) to test the treatment effect for their significance (Snedecor and Cochran, 1967). Duncan Multiple Range Test (DMRT) was used to separate the means. IBM statistically package for social science (SPSS) computer software was use in running in analysis of variance.

RESULT AAND DISCUSSION

Effect of Variety and Poultry Manure on Plant Height of Papaya Seedlings

The effect of variety and poultry manure levels on plant height of papaya seedlings during the 2023 and 2024 dry seasons are shown in Tables 1 and 2. The result revealed a significant ($P \leq 0.05$) difference among the treatments throughout the study period. The result further showed that, except at 2023 where sun grads variety proved to be significantly ($P \leq 0.05$) better in terms of taller plants, no significant effect was observed throughout the study period. The increase in plant height and stem girth may be due to the improvement of physical properties of soil, higher nutrient uptake, and increased activity of microorganisms which were manifested in the form of enhanced growth and higher carbohydrate production (Yadav, *et al.*, 2011). Application of poultry manure significantly ($P \leq 0.05$) increased papaya plant height throughout the sampling period. Plant height increased with the increasing application of poultry manure up to 0.8kg/pot in both the seasons under study. The results of this experiments confirmed the findings of Ali *et al.* (2014) and Perez *et al.* (2014) who stated that poultry manure plays a vital role in supporting plant growth in the vegetative growth phase.

Table: Effect of Variety and Poultry Manure on Plant Height of Papaya Seedlings during 2023 Season

Treatment	Plant height					
Varieties	2WAT	4WAT	6WAT	8WAT	10WAT	12WAT
Calina IPB9 True Dwarf	25.81 ^b	32.44 ^b	37.59 ^b	39.75 ^b	47.86 ^b	53.43 ^b
Sun Grads	29.48 ^a	38.59 ^a	43.77 ^a	47.18 ^a	53.43 ^a	60.19 ^a
LS	*	*	*	*	*	*
SE± ($P \leq 0.05$)	0.502	0.530	0.854	0.944	1.215	1.221
Poultry Manure Level (kg/pot)						
0.0kg	27.58 ^{ab}	35.47 ^b	40.98 ^{ab}	43.03 ^{ab}	50.58 ^{ab}	56.30 ^{ab}
0.2kg	26.13 ^b	33.43 ^b	37.97 ^b	41.33 ^{ab}	47.03 ^b	53.15 ^b
0.4kg	27.68 ^{ab}	35.20 ^b	40.68 ^{ab}	42.55 ^{ab}	50.80 ^{ab}	55.92 ^{ab}
0.6kg	27.27 ^{ab}	34.62 ^b	40.33 ^{ab}	42.67 ^{ab}	50.77 ^{ab}	57.43 ^{ab}
0.8kg	29.57 ^a	38.87 ^a	43.42 ^a	47.75 ^a	57.05 ^a	61.25 ^a
LS	*	*	*	*	*	*
SE± ($P \leq 0.05$)	0.794	0.838	1.350	1.493	1.920	1.931
Interaction						
V×PM	NS	NS	NS	NS	NS	NS

Means in column of any set of treatment(s) followed by a different letter (s) are significantly different, SE= Standard Error, *= Significant at ($P \leq 0.05$), **= Significant at ($P \leq 0.001$), NS= Not Significant, WAT= weeks after treatment.



Table 2: Effect of Variety and Poultry Manure on Plant Height of Papaya Seedlings during 2024 Season

Treatment	Plant height					
Varieties	2WAT	4WAT	6WAT	8WAT	10WAT	12WAT
Calina IPB9 True Dwarf	27.05	31.50	37.48	46.84	52.23	53.95
Sun Grads	25.24	32.75	40.78	49.28	53.43	57.53
LS	NS	NS	NS	NS	NS	NS
SE± (P≤0.05)	1.174	1.414	1.539	0.864	1.005	1.933
Poultry Manure Level (kg/pot)						
0.0kg	23.02 ^{bc}	30.25 ^{ab}	39.00	46.68 ^b	51.33 ^b	52.07
0.2kg	27.47 ^{abc}	36.27 ^a	40.97	47.18 ^b	50.18 ^b	56.30
0.4kg	29.55 ^a	30.98 ^{ab}	37.15	46.87 ^b	52.08 ^{ab}	54.53
0.6kg	22.05 ^c	28.80 ^b	36.67	47.37 ^b	53.27 ^{ab}	53.73
0.8kg	28.65 ^{ab}	34.33 ^{ab}	41.87	52.20 ^a	56.67 ^a	62.07
LS	*	*	NS	*	*	NS
SE± (P≤0.05)	1.856	2.235	2.433	1.366	1.588	3.057
Interaction						
V×PM	NS	NS	NS	NS	NS	NS

Means in column of any set of treatment(s) followed by a different letter (s) are significantly different, SE= Standard Error, *= Significant at (P≤0.05), NS= Not Significant, WAT= weeks after treatment.

Effect of Variety and Poultry Manure on Number of Leaves of Papaya Seedlings

The results as presented in Table 3 and 4 shows the effect of poultry manure and variety on number of leaves of papaya seedlings. The result indicated that variety had no significant (P≤0.05) effect on number of leaves of papaya. The result further indicated that, except at 8 and 12 WAT in 2023 and 6 WAT in 2024 where application of 0.8 kg produced the highest number of leaves, no significant (P≤0.05) difference was observed throughout the study period. The result of this study agree with the findings of (Maryani *et. al.*, 2021), who stated that poultry had no influence on number of leaves of papaya which might be due to sharing of genetic character.

Table 3: Effect of Variety and Poultry Manure on Number of Leaves of Papaya Seedlings during the 2023 Season

Treatment	Number of leaves					
Varieties	2WAT	4WAT	6WAT	8WAT	10WAT	12WAT
Calina IPB9 True Dwarf	11.67	11.80	13.13	13.80	10.60	18.53
Sun Grads	11.47	12.40	12.80	13.73	10.40	17.47
LS	NS	NS	NS	NS	NS	NS
SE± (P≤0.05)	0.501	0.586	0.529	0.725	0.296	0.263
Poultry Manure Level (kg/pot)						
0.0kg	11.50	11.50	12.67	15.17 ^a	10.50	14.17 ^b
0.2kg	11.17	11.83	12.83	15.83 ^a	10.50	19.50 ^{ab}
0.4kg	12.00	12.33	12.50	13.67 ^{ab}	10.67	13.83 ^b
0.6kg	12.50	12.83	13.33	13.33 ^{ab}	11.00	17.17 ^{ab}
0.8kg	10.67	11.83	13.50	10.83 ^b	9.83	25.33 ^a
LS	NS	NS	NS	*	NS	*
SE± (P≤0.05)	0.792	0.927	0.836	1.146	0.467	0.112
Interaction						
V×PM	NS	NS	NS	NS	NS	NS

Means in column of any set of treatment(s) followed by a different letter (s) are significantly different, SE= Standard Error, *= Significant at (P≤0.05), NS= Not Significant, WAT= weeks after treatment.



Table 4: Effect of Variety and Poultry Manure on Number of Leaves of Papaya Seedlings during 2024 Season

Treatment	Number of leaves					
Varieties	2WAT	4WAT	6WAT	8WAT	10WAT	12WAT
Calina IPB9 True Dwarf	7.07	10.33	11.27	12.67	16.93	14.27
Sun Grads	6.07	8.87	12.60	13.93	15.27	13.47
LS	NS	NS	NS	NS	NS	NS
SE± (P≤0.05)	0.540	0.473	0.858	0.865	1.651	0.756
Poultry Manure Level (kg/pot)						
0.0kg	6.67	8.83	10.83 ^{ab}	12.00	14.50	14.17
0.2kg	5.67	10.33	15.17 ^a	13.33	17.33	13.50
0.4kg	6.17	8.83	13.00 ^{ab}	12.00	16.00	13.00
0.6kg	7.00	9.50	9.67 ^{ab}	14.00	13.17	13.67
0.8kg	7.33	10.50	11.00 ^{ab}	15.00	19.50	15.00
LS	NS	NS	*	NS	NS	NS
SE± (P≤0.05)	0.854	0.747	1.356	1.367	2.611	1.196
Interaction						
V×PM	NS	NS	NS	NS	NS	NS

Means in column of any set of treatment(s) followed by a different letter (s) are significantly different, SE= Standard Error, *= Significant at (P≤0.05), NS= Not Significant, WAT= weeks after treatment.

Effect of Variety and Poultry Manure on Stem Girth of Papaya Seedlings

The effect of variety and poultry manure on stem girth of papaya seedlings during the 2023 and 2024 dry seasons are presented in Tables 5 and 6, respectively. The stem girth was not significantly (P≤0.05) affected by variety throughout the two seasons. This could be attributed to variation in genotype, adaptation and environmental factors which may affect the performance of the varieties. The result of these experiments confirmed the findings of Meena *et al.* (2017). The result further showed that, application of poultry manure significantly (P≤0.05) increased the stem girth of papaya seedlings in the 2023 season, 4, 8, and 10WAT affected by poultry manure where at 4 WAT poultry manure level 0.6 kg/pot gave thicker stems while at 8 and 10 WAT poultry manure level 0.8 kg/pot gave bigger stem in 2023 season. However, in the 2024 season there was no significant (P≤0.05) difference among the treatments throughout the season. The considerable increase obtained in stem girth might be due to adequate release of nutrients by poultry manure which was absorbed by papaya seedlings. Perez, *e. al.* (2014) reported that poultry manure plays a vital role in supporting plant growth in the vegetative growth phase.



Table 5: Effect of Variety and Poultry Manure on Stem Girth of Papaya Seedlings during 2023 Season

Treatment	Stem girth					
Varieties	2WAT	4WAT	6WAT	8WAT	10WAT	12WAT
Calina IPB9 True Dwarf	1.61	2.23	2.65	3.21	3.77	4.70
Sun Grads	1.69	2.15	2.69	3.07	3.76	4.73
LS	NS	NS	NS	NS	NS	NS
SE± (P≤0.05)	0.099	0.066	0.615	0.070	0.059	0.110
Poultry Manure Level (kg/pot)						
0.0kg	1.67	2.03 ^b	2.63	3.22 ^b	3.82 ^b	4.75
0.2kg	1.50	2.20 ^{ab}	2.52	2.97 ^{ab}	3.60 ^{ab}	4.62
0.4kg	1.52	2.13 ^{ab}	2.63	3.15 ^{ab}	3.67 ^{ab}	4.85
0.6kg	1.89	2.38 ^a	2.77	3.33 ^{ab}	3.80 ^{ab}	4.63
0.8kg	1.68	2.18 ^{ab}	2.78	3.37 ^a	3.93 ^a	4.73
LS	NS	*	NS	*	*	NS
SE± (P≤0.05)	0.157	0.105	0.097	0.110	0.093	0.174
Interaction						
V×PM	NS	NS	NS	NS	NS	NS

Means in column of any set of treatment(s) followed by a different letter (s) are significantly different, SE= Standard Error, *= Significant at (P≤0.05), NS= Not Significant, WAT= weeks after treatment.

Table 6: Effect of Variety and Poultry Manure on Stem Girth of Papaya Seedlings during 2024 Season

Treatment	Stem girth					
Varieties	2WAT	4WAT	6WAT	8WAT	10WAT	12WAT
Calina IPB9 True Dwarf	1.78	2.77	4.33	5.11	6.89	8.87
Sun Grads	1.95	2.70	4.48	5.08	6.77	8.86
LS	NS	NS	NS	NS	NS	NS
SE± (P≤0.05)	0.083	0.177	0.492	0.357	0.578	0.614
Poultry Manure Level (kg/pot)						
0.0kg	1.90	3.07	4.40	4.73	6.90	9.00
0.2kg	1.77	3.06	4.72	5.90	5.97	9.00
0.4kg	1.87	2.48	3.60	4.65	6.48	8.50
0.6kg	1.95	2.75	5.05	5.42	7.85	9.17
0.8kg	1.78	2.78	4.27	4.78	6.97	8.67
LS	NS	NS	NS	NS	NS	NS
SE± (P≤0.05)	0.134	0.280	0.778	0.553	0.913	0.971
Interaction						
V×PM	NS	NS	NS	NS	NS	NS

Means in column of any set of treatment(s) followed by a different letter (s) are significantly different, SE= Standard Error, *= Significant at (P≤0.05), NS= Not Significant, WAT= weeks after treatment.

Effect of Variety and Poultry Manure on Number of Nodes of Papaya Seedlings

The effect of variety and poultry manure on number of nodes of papaya seedlings during the 2023 and 2024 dry seasons are presented in Tables 7 and 8 respectively. The number of nodes was not significantly (P≤0.05) affected by variety throughout the sampling period. This could be attributed to luxury consumption by the papaya seedlings due to the excess release of nutrients by poultry manure, particularly Nitrogen, Phosphorus and Potassium. This results correspond to the earlier findings of Pastors *et al.* (2010). Poultry manure on the other hand, except at 12 WAT where 0.8 kg/pot produced significantly (P≤0.05) higher number of nodes, no significant difference was observed throughout the

study period. The results of these experiments agree with the findings of Lim and Hawa (2007), who stated that this might be due to the sharing of genetic character.

Table 7: Effect of Variety and Poultry Manure on Number of Nodes of Papaya Seedlings during 2023 Season

Treatment	Number of node					
Varieties	2WAT	4WAT	6WAT	8WAT	10WAT	12WAT
Calina IPB9 True Dwarf	10.53	13.33	15.87	18.87	26.20	30.87
Sun Grads	11.00	13.80	16.40	19.87	25.40	39.40
LS	NS	NS	NS	NS	NS	NS
SE± (P≤0.05)	0.26	0.26	0.31	0.33	0.38	3.65
Poultry Manure Level (kg/pot)						
0.0kg	10.33	13.33	16.00	19.17	25.50	31.00 ^b
0.2kg	10.17	13.00	15.50	19.17	25.00	52.17 ^a
0.4kg	11.33	14.17	16.00	18.83	25.33	27.17 ^b
0.6kg	11.33	14.17	16.50	19.17	25.33	32.50 ^b
0.8kg	10.67	13.17	16.67	19.83	26.83	32.83 ^b
LS	NS	NS	NS	NS	NS	*
SE± (P≤0.05)	0.430	0.422	0.150	0.475	0.495	0.715
Interaction						
4V×PM	NS	NS	NS	NS	NS	NS

Means in column of any set of treatment(s) followed by a different letter (s) are significantly different, SE= Standard Error, *= Significant at (P≤0.05), NS= Not Significant, WAT= weeks after treatment.

Table 8: Effect of Variety and Poultry Manure on the Number of Nodes of Papaya Seedlings during 2024 Season

Treatment	Number of node					
Varieties	2WAT	4WAT	6WAT	8WAT	10WAT	12WAT
Calina IPB9 True Dwarf	11.13	16.40	20.33	24.07	30.40	39.87
Sun Grads	11.80	15.73	21.07	25.80	32.13	38.53
LS	NS	NS	NS	NS	NS	NS
SE± (P≤0.05)	0.398	0.609	1.108	0.948	1.083	1.394
Poultry Manure Level (kg/pot)						
0.0kg	11.00	14.83 ^b	20.33	24.33	30.33	37.33
0.2kg	11.17	15.67 ^{ab}	22.50	26.00	31.83	42.83
0.4kg	11.83	15.67 ^{ab}	20.83	24.17	31.50	38.83
0.6kg	11.83	18.50 ^a	19.17	23.50	33.17	37.33
0.8kg	11.50	15.67 ^{ab}	20.67	26.67	29.50	39.17
LS	NS	*	NS	NS	NS	NS
SE± (P≤0.05)	0.629	0.964	1.739	1.499	1.712	2.205
Interaction						
V×PM	NS	NS	NS	NS	NS	NS

Means in column of any set of treatment(s) followed by a different letter (s) are significantly different, SE= Standard Error, *= Significant at (P≤0.05), NS= Not Significant, WAT= weeks after treatment.

CONCLUSION AND RECOMMENDATIONS

The study concluded that the application of cured poultry manure enhanced the growth performance of papaya seedlings. Application of poultry manure affect the moisture stress of papaya seedlings. Based on the result of this findings, application of 0.8kg/pot poultry manure is suggested to enhance growth performance and resistance to moisture stress of the considered papaya seedlings. More research with other organic manure as a source of nutrients is also recommended to explore more inference.



REFERENCES

- Ali, A., Muhammad, M. T. M., Sijam, K., and Siddiqui, Y. (2014). Effect of Chitosan Coatings on the Physicochemical Characteristics of Eksotika II Papaya (*Carica Papaya* L.) Fruit during Cold Storage. *Food Chemistry*, **124**(2): 620-626.
- Embrapa. 2018. Visão 2030: O futuro da agricultura Brasileira. Brasília: Empresa Brasileira de Pesquisa Agropecuária.
- IPB prepare to launch Seed Center" (<http://www.antaranews.com/en/news/73107/ipb-to-launch-seed-center>) ANTARA News. Retrieved **25** September 2013.
- IBGE. Brazilian Institute of Geography and Statistics. Municipal Agricultural Production 2018.
- Lima RCA, Souza Jr. MT, Pio-Ribeiro G, Lima JAA (2016) Sequences of the coat protein gene from Brazilian isolates of Papaya ringspot virus. *Fitopatologia Brasileira* **27**: 174-180.
- Lim RCA, Hawa, G.A., Souza Jr. MT, Pio-Ribeiro G, Lima JAA (2007) Sequences of the coat protein gene from Brazilian isolates of Papaya ringspot virus. *Fitopatologia Brasileira*, **27**: 174-180.
- Maryani, A.T., Mirna, N. and Bahar, F.F. (2021). International Conference on Environmental and Sustainability Context IOP Conf. Series: Earth and Environmental Science **10**: 894- 903.
- Meena, A.K., O.P. Garhwal, A., Kumar, M. and Singh, S.P. (2017). Effect of Different Growing Media on Seedling Growth Parameters and Economics of Papaya (*Carica papaya* L.) cv. Pusa Delicious. *Int. J. curr. Microbiol. App. Sci.*, **6**(6): 2964-2972.
- Mesquita, M. S., Gonçalves, C. A. A., Cruz, V. A., Masson, G. A., Alvarez, M. C., & Costa, L. L. (2017). Avaliação centesimal e sensorial da geleia de morango com adição de semente de mamão (*C. Papaya*). *Anais do Seminário de Pesquisa e Inovação Tecnológica*, **1**(1): 1-9.
- Pastor, M. C. R., Rodrigo, M. G. L. and Sanchez, M. L. S. (2010). Behavior of papaya cultivars Sunset, Sunrise and genotypes of „Baixinho De Santa Amalia“ and BH - 65 in the South of Tenerife Island. *Rev.Bras.Frutc., Jaboticabal – SP.*, **32**(4): 1105-1115.
- Perez, A., Reyes, M. N. and Cuevas, J. (2014). Germination of two papaya varieties: effect of seed aeration, K-treatment, removal and sarcotesta, high temperature, soaking in distilled water, and age of the seed. *Journal of the Agricultural University of Puerto Rico*, **64**: 173-180.
- Siqueira, D.L. de, Botrel, N., Clima (2012). e Solo para a cultura do mamoeiro, *Informe Agropecuario*, **13**(6): 8–9.
- Yadav, P. K., Yadav, A. L., Yadav, A. S. and Yadav, H. C. (2011). Effect of integrated nutrient nourishment on vegetative growth and physico-chemical attributes of papaya (*Carica papaya* L.) fruit cv. Pusa Dwarf. *Plant Archives*, **11**(1): 327- 329.