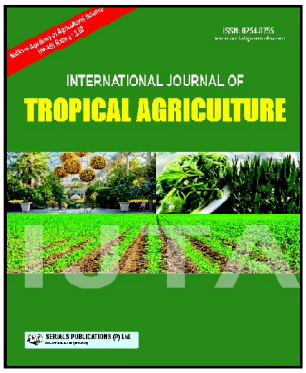

INTERNATIONAL JOURNAL OF TROPICAL AGRICULTURE

ISSN : 0254-8755

available at http: www.serialsjournal.com

Volume 35 • Number 4 • 2017

Effects of Different Shoot Cuttings and Soil Media on Number of Leaves and Roots in Rapid Multiplication of Pineapple (*Ananas comosus* L. Merr.) Cv. Kew

Khamrang Mathukmi[1]*, W. Ingo Meitei[2], Haribhushan Athokpam[3] and Sabastian KS[4]

[1] *Ethno Medicinal Research Centre, P.O. Kangpokpi – 795129, Manipur – India*
[2] *Department of Horticulture, Central Agricultural University, P.O. Lamphel – 795004, Manipur - India*
[3] *Krishi Vigyan Kendra (Farm Science Centre), Senapati District, P.O. Kangpokpi - 795129, Manipur- India*
[4] *Department of Horticulture, School of Agricultural Science and Rural Development, Medziphema Campus Nagaland University, Nagaland – 797106, India, * Corresponding Author: E-mail: mkhamrang.agri13@gmail.com*

Abstract: The aim of this research was to ascertain the influence of different shoot cuttings and soil media on number of leaves and roots and also to popularize the rapid multiplication technique in Pineapple (*Ananas comosus* L. Merr.) Cv. Kew plantlets production. The experiment was conducted in the green house chamber of the Department of Horticulture, College of Agriculture, Central Agricultural University, Imphal, Manipur. Shoot cuttings of suitable size from slips, suckers, crown, mother plant (before fruiting - BF) and mother plant (after fruiting - AF) were evaluated for pineapple plantlets production. As the propagation media, hill soil, riverbed sand and brick sand were compared for number of leaves and roots at 20 days intervals up to 140 days after planting (DAP). A 3×5 factorial combination in a randomized complete block design with three replicates was planned. Mother plant (after fruiting) shoot cuttings significantly performed better than all the other shoot cuttings and gave the highest number of vigorous plantlets by using brick sand media.

Key Words: Pineapple, Rapid Multiplication, Shoot cuttings and Soil Media

INTRODUCTION

Pineapple (*Ananas comosus* L. Merr.) is a perennial herb belonging to the family Bromeliaceae, native to the American tropics. It is one of the most important commercial fruit crops of the tropical and sub-tropical regions of the world. Pineapples are

grown all year round in the warmer climates and were originally consumed only as a fresh fruit [1]. With the development of the processing industry, the fruit is highly valued because of its excellence in canning and other processing industries for the production of nutritious and value added product like jam, jelly, candy, juices, syrups, crushed pineapple among others.

Out of many varieties proven for yield, quality and processing, the performance of Kew (syn. Smooth Cayenne) was found to be superior in all respects compared to other varieties *viz.,* Queen, Mauritius, Red Spanish, etc. [2]. Pineapples have been traditionally propagated using three types of propagules: crowns, suckers and slips [3][4]. However the cultivars in the cayenne group produce only one or two suckers per plant and seldom more than three slips [3][4][5]. The average rate of production of sucker is about 0-2 per year [6]. Thus, it takes about 30-35 years in order to produce enough planting materials for one hectare from a single mother plant. Moreover, the crown sections become unavailable for planting when the fruit and crown are sold together as a fresh fruit.

In the way of expansion of pineapple cultivation, mass propagation technique is needed to be developed. One of the technologies that can be used for this purpose is the *in vitro* technique. The use of this technique has two advantages. It can be used to produce large number and uniform pineapple propagules in a relatively short period of time [7], and can also be used to improve plant performances. However, this method is so sophisticated and requires skilled labour force. There is an alternative rapid propagation technique using stem cutting under *in vivo* conditions. This method has numerous advantages. Many new plants can be started in a limited space from a few stock plants. It is inexpensive, rapid and simple and does not require the special techniques necessary in micropropagation. Greater uniformity is obtained [8]. The parent plant is usually reproduced exactly, with no genetic change [9]. It is easier to perform than *in vitro* tissue culture, and after out-planting into the nursery, tissue culture plantlets need higher levels of subsequent care (i.e., photoperiod and temperature maintenance) than plants derived from stem cuttings [10].

The aim of the research was to ascertain the influence of different shoot cuttingsand soil media on number of leaves and roots in production of pineapple plantlets and ultimately standardize a reliable protocol for rapid multiplication in order to meet the huge demands of pineapple plantlets.

MATERIALS AND METHODS

The experiment was conducted in the green house chamber of the Department of Horticulture, College of Agriculture, Central Agricultural University, Imphal, during the year 2014 – 2015. Three soil media *viz.*, hill soil, riverbed sand and brick sand were used for planting different shoot cuttings *viz.*, slips, suckers, crown and mother plant (before fruiting – BF and after fruiting - AF). The experiment was laid out in a Factorial Randomized Block Design (FRBD) with 3 number of replication and 15 numbers of treatments. These 15 treatments were as follows:

a) Hill soil + slips cuttings - (S_1P_1)

b) Hill soil + suckers cuttings - (S_1P_2)

c) Hill soil + crown cuttings - (S_1P_3)

d) Hill soil + mother plant (BF) cuttings - (S_1P_4)

e) Hill soil + mother plant (AF) cuttings - (S_1P_5)

f) Riverbed sand + slips cuttings - (S_2P_1)

g) Riverbed sand + suckers cuttings - (S_2P_2)

h) Riverbed sand + crown cuttings - (S_2P_3)

i) Riverbed sand + mother plant (BF) cuttings - (S_2P_4)

j) Riverbed sand + mother plant (AF) cuttings - (S_2P_5)

k) Brick sand + slips cuttings - (S_3P_1)

l) Brick sand + suckers cuttings - (S_3P_2)

m) Brick sand + crown cuttings - (S_3P_3)

n) Brick sand + mother plant (BF) cuttings - (S_3P_4)

o) Brick sand + mother plant (AF) cuttings - (S_3P_5)

Each treatment was composed of twenty cuttings. The cuttings were prepared after the leaves and roots are shredded and the stems were cut into 3 – 4 longitudinal slices of 2 cm thick. Again, it was cut transversely into triangular slices containing 2 – 3 nodes. Stem cuttings were planted with 1/4 of bottom part buried in the soil and the remaining top was covered with fine layer of soil with a spacing of 5 x 5 cm apart in 25 x 20 cm plot. Observations were performed on number of leaves and roots. Number of leaves and roots were represented by accumulation of all leaves and roots that were counted from the day of appearance to the last observation. Observations were done at 20 days interval up to 140 days. The collected data on the different parameter of study were statistically analysed to find out the significance of differences between the treatments. The means of all the treatments were calculated and the analyses of variances (ANOVA) for all the characters were performed by 'F' variance test. The significances of differences between treatments means were compared by Least Significant Difference (LSD) test.

In order to test the significance of mean differences between treatments, the following statistics were computed.

A. Standard error of mean differences (S.Ed)

$$S.E(d) = \sqrt{\frac{2 \times EMS}{r}}$$

Where,

EMS = Error mean sum of square

r = Number of replications

B. Critical difference (C.D)

C.D = S.E(d) X $t_{.05}$ for error degrees of freedom

RESULTS AND DISCUSSION

Number of leaves

The data on number of leaves at 40 through 140 days after planting are presented in Table 1 and graphically in Figure 1. As evidence from the given data, mother plant (AF) produces more number of leaves as compared to other shoot cuttings. Also, soil media had significant effect on the number of leaves produced. The number of leaves significantly increased over a period of time. More number of leaves was recorded in brick sand media followed by hill soil media and least in riverbed sand media. Similar results have been obtained in *Gongronema latifolia* Benth where the highest number of leaves was obtained when planted in brick sand media which may be attributed to the longest length of both lateral/tap roots which favours the absorption of nutrients [11]. Another study shows that sand media mixed with manure and soil in the ratio of 2:1:2 produced highest number of leaves in planting of pineapple seedling [12]. Also, in rooting of *Plantanus orientalis* L. cuttings, sand + perlite produced the highest number of leaves [13]. Meanwhile, the least number of leaves per plant was observed in shoot cuttings from crown planted in riverbed sand media. This is in agreement with the findings in *Matthiola incana* [14] seedlings and *Ficus binnendijkii* [15] cuttings.

Number of roots

Shoot cuttings and soil media had no significant effect on the number of roots up to 100 days after planting (Table 2 & Figure 2). Data recorded at 120 and 140 days after planting show significant result

Table 1
The effect of different shoot cuttings and soil media on number of leaves at 40 through 140 days after planting

Treatments	*Leaves number at 40 through 140 days after planting*					
	40	*60*	*80*	*100*	*120*	*140*
S_1P_1	3.17	3.88	5.04	5.76	6.47	7.25
S_1P_2	3.11	3.86	4.91	5.73	6.46	6.95
S_1P_3	3.09	3.70	4.71	5.58	6.19	6.77
S_1P_4	3.22	4.12	5.14	6.07	6.64	7.28
S_1P_5	3.33	4.17	5.26	6.15	6.88	7.36
S_2P_1	3.13	3.60	4.92	5.60	6.24	7.12
S_2P_2	3.05	3.59	4.80	5.54	6.20	6.88
S_2P_3	3.02	3.47	4.50	5.29	5.94	6.48
S_2P_4	3.09	3.76	4.93	5.64	6.28	7.15
S_2P_5	3.29	3.99	5.07	5.97	6.57	7.23
S_3P_1	3.30	3.99	5.20	6.12	6.73	7.48
S_3P_2	3.26	3.95	5.11	5.91	6.60	7.11
S_3P_3	3.14	3.89	4.88	5.70	6.30	6.89
S_3P_4	3.84	4.84	5.30	6.13	7.10	7.65
S_3P_5	4.36	5.65	6.36	7.27	7.67	8.24
SE(d) ±	0.11	0.10	0.10	0.06	0.07	0.05
$CD_{(0.05)}$	0.21	0.20	0.20	0.11	0.13	0.11

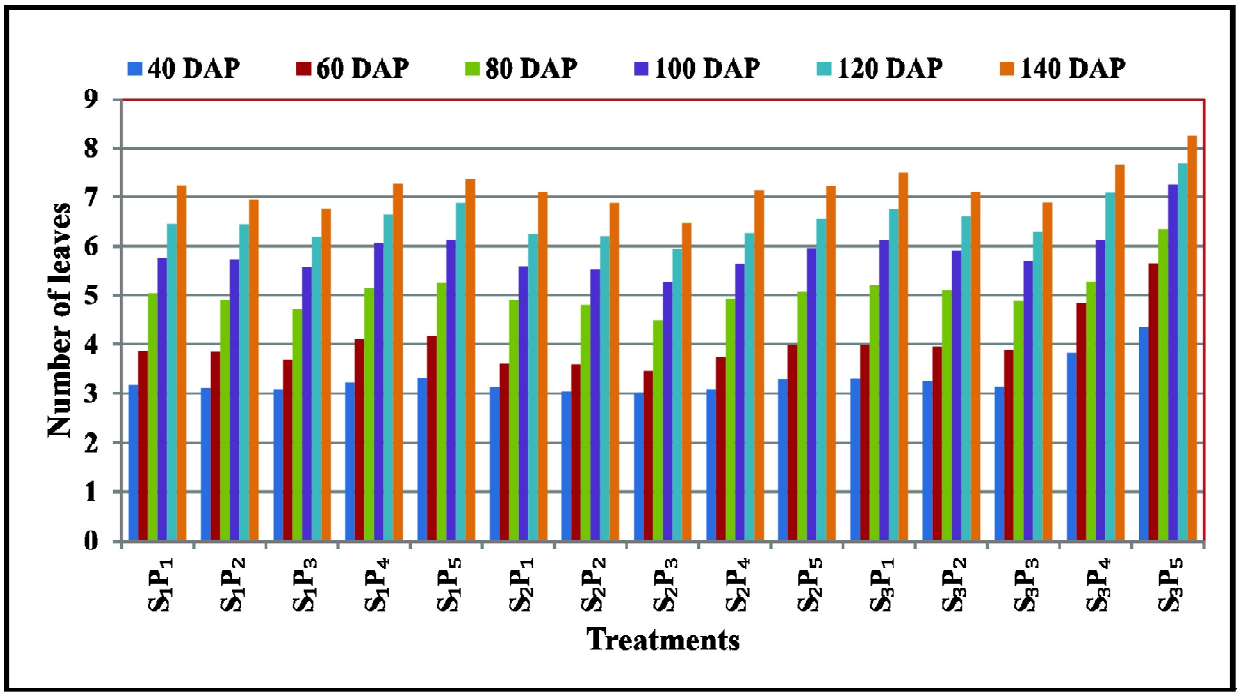

Figure 1: Effect of different shoot cuttings and soil media on number of leaves

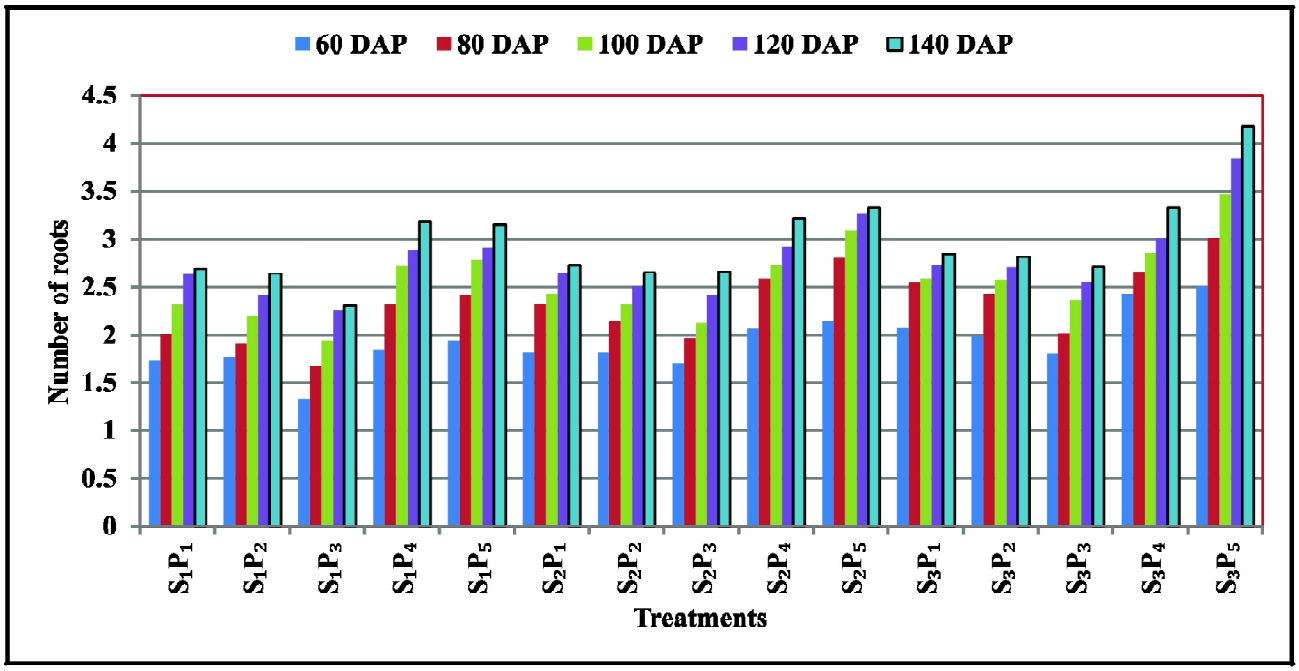

Figure 2: Effect of different shoot cuttings and soil media on number of roots

Table 2
Effect of different shoot cuttings and soil media on number of roots at 60 through 140 days after planting

Treatments	*Number of roots at 60 through 140 days after planting*				
	60	*80*	*100*	*120*	*140*
S_1P_1	1.74	2.01	2.32	2.63	2.69
S_1P_2	1.77	1.91	2.21	2.43	2.64
S_1P_3	1.33	1.67	1.94	2.26	2.31
S_1P_4	1.84	2.32	2.72	2.89	3.18
S_1P_5	1.94	2.42	2.79	2.91	3.15
S_2P_1	1.82	2.33	2.44	2.65	2.73
S_2P_2	1.82	2.14	2.32	2.51	2.65
S_2P_3	1.71	1.97	2.12	2.42	2.66
S_2P_4	2.07	2.59	2.73	2.93	3.22
S_2P_5	2.14	2.81	3.09	3.27	3.33
S_3P_1	2.08	2.54	2.59	2.73	2.85
S_3P_2	1.99	2.44	2.58	2.71	2.82
S_3P_3	1.81	2.02	2.37	2.56	2.71
S_3P_4	2.44	2.66	2.86	3.01	3.33
S_3P_5	2.51	3.02	3.47	3.85	4.18
SE(d) ±	0.14	0.13	0.11	0.05	0.05
$CD_{(0.05)}$	NS*	NS*	NS*	0.09	0.09

*Not Significant

where mother plant (AF) planted in brick sand media exhibited highest number of roots production per cuttings. Similar results have been reported in *Mussaenda philippica* A. Rich [16], *Dodoreae viscosa* L. [17] and *Gongronema latifolia* Benth [11] cuttings. The well aerated and loose texture of sand allows room for higher numbers of roots and vigorous root growth. The quality of roots in terms of number and length is very important for the successful establishment of the cuttings. Cuttings rooted in sand medium also had well differentiated callus and higher percentage of callus formation. Rooting medium can influence the type of callus produced, which in turn can affect emergence of newly-formed adventitious roots [18]. On the other hand, hill soil media recorded the least number of roots. Corresponding results were obtained in *Gongronema latifolia* Benth [11] and *Dalbergia melanoxylon* Guill. & Perr. [19].Poor rooting in hill soil media could be attributed to resistance to penetration [20] which argued that it is dependent on water content, bulk density, structure and strength of the soil.

CONCLUSIONS

On the basis of results obtained from this study, it can be concluded that shoot cuttings of mother plant (AF) planted in brick sand media showed good response to growth and development of leaves and roots. And thus, these methods can be considered as the best technique for rapid multiplication of pineapple by shoot cuttings under *in vivo* conditions.

REFERENCES

Loeillet, D. (1997), The world pineapple market: The importance of Europe. *Acta Hort.,* **425**: 37-48.

Gopimony, R., Balakrishnan, S. and Marykutty, K.C. (1978), A comparative study of certain fruit qualities of twenty pineapple varieties. *Agri. Res. J. Kerala.*, **16**(1): 28 – 32.

Collins, J.L. (1960), The Pineapple. Leonard Hill, London, p. 294.

Py, C., Lacocuilhe, J.J. and Teisson, C. (1987), The Pineapple: Cultivation and Uses. G.P. Maisonneuve and Larose, Paris, p. 564.

Nakasone, H.Y. and Paull, R.E. (1998), Tropical Fruits. CAB International, Madison, NY, p. 443.

Purseglove, J.W. (1972), Tropicals Crops. Monocotyledons. Longman, London, pp. 79 – 91.

Firoozabady, E., Heckert, M. and Gutterson, N. (2003), Transformation and regeneration of pineapple. *Plant Cell.Tissue Organ. Cult.,* **84**: 1.

Nasution, F. and Hadiati, S. (2012), The effect of BAP and the level of aging stem on the growth of pineapple (*Ananas comosus* L. Merr.) stem cutting. *J. Agric. Biol. Sci.*, **7**(3): 193-195.

Hartmann, H. T., Kester, D. E. and Davies, F.T. (1990), Plant Propagation: Principles and practices. Prentice – Hall International Inc., New Jersey, USA, p. 646.

Soni, V. (2010), Efficacy of *in vitro* tissue culture versusstem cuttings for propagation of *Commiphora wightii* in Rajasthan, India. *Conserv. Evid.*,**7**: 91-93.

Ofodile, E.A.U., Chima, U.D. and Udo, E.F. (2013), Effect of different growth media on foliage production and root growth in *Gongronema latifolia* Benth stem cuttings. *Greener J. Agric. Sci.,***3**(3): 215-221.

Indriyani, N.L.P., Hadiati, S. and Soemargono, A. (2011), The effect of planting medium on the growth of pineapple seedling. *APRN J. Agric. biol. Sci.,***6**(2): 43-48.

Tagipoor, L., Mahmodzadeh, H. and Jabarzadeh, Z. (2015), Effect of rooting beds, IBA concentrations and bottom heat on rooting of plane tree (*Plantanus orientalis* L.) cuttings. *Int. J. Biosci.*, **6**(3):76-82.

Waseem, K., Hameed, A., Saleem, M.J., Kiran, M., Ghazanfarullah, M.R., Javeria, S. and Jilani, T.A. (2013), Effect of different growing media on the growth and flowering of stock (*Matthiola incana*) under the agro-climatic condition of Dera Ismail Khan. *Pak. J. Agri. Sci.,* **50(**3): 523 - 527.

Shah, M., Mateen A.K., and Amin, N. (2006), Effect of different growing media on the rooting of *ficus binnendijkii*'Amstel Queen' cuttings. *J. Agric. Biol. Sci.*, **1**(3): 15 - 17.

Olosunde, O.M., Olasantan, F. O. and Olubode, O.O. (2008), Effect of Growth Media on Rooting of Queen of the Philippine (*Mussaenda philippica*A. Rich). *Nigerian J. Hort. Sci.,* **13**: 68 - 74.

Saffari, M. and Saffari, V.R. (2012), Effects of media and Indole Butyric Acid (IBA) concentrations on hopbush (*Dodoneae viscosa* L.) cuttings in green house. *Annals For. Res.*, **55**(1): 61 - 68.

Hartmann, H.T., Kester, D.E., Davies, F.T. and Geneveve, R.L. (1997), Plant Propagation: Principles and Practices, Prentice – Hall, Inc. Upper Saddle River, New Jersey, p. 770.

Amri, E., Lyaruu, H.V.M., Nyomora, A.S. and Kanyeka, Z.L. (2009), Evaluation of Provenances and Rooting Media for Rooting Ability of African Blackwood (*Dalbergia melanoxylon* Guill.& Perr.)stem cuttings. *Res. J. Agric. and Biol. Sci.*, **5**(4): 524 - 532.

Bradford, J.M. (1986), Penetrability. In: Klute. A, (ed). Methods of soil analysis.Part 1.Physical and Mineralogical Methods. Agronomy Monograph No. 9. (Klute A, ed), Madison, Wisconsin, USA: Soil Science Society of America, pp. 463 – 478.