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Effects of Number of Splitted Slips on the Development of Pineapple (*Ananas Cosmosus*) Seedling

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Abstract: A study was conducted to assess the effects of number of splitted slips on the development of pineapple seedling. A potted experiment in the greenhouse consisting of two varieties (smooth cayenne and red spanish) and four number of splited slips (2, 4, 6 and 8) in complete randomized design (CRD) with three replications. All parameters were taken through eight months growing time starting from planting. The results revealed that a significant difference of the experiment, the pineapple variety red spanish performed better than the smooth cayenne in respect of some seedling growth parameters. The effects of splitting the slips in to 2 and 4 times on the variety of red spanish and smooth cayenne seedlings respectively have better plant height, number of leaves, leaf area Index, dry biomass per plant, vigor Index and Seedling Survival count. Significantly maximum fresh biomass yield was recorded by spliting red spanish slips variety in to 2 times was 23.42 gm/plant which have no biomass difference with all number of splited slips and pineapple variety combination except 6 times splited slips of the tow variety. The heights leaf area index recorded at the treatment which contain red spanish variety with 2 times splited slips and next to that planting smooth cayenne variety with 4 times splited slips. The lowest leaf area index recorded by the variety smooth cayenne splited the slips 8 times which was lower by 43.33% from the variety red Spanish splited the slips 2 times. The analysis of variance indicated significant ($P < 0.05$) interaction effects of pineapple variety and number of slips splited on the seedling survival count. The highest number of survived seedlings (100%) were counted by planting red spanish variety with 2 times splited slips which have significant survival difference with planting smooth cayenne slips splited 8 times (66.67%). The seedlings grown from the spliting of red Spanish slips at 2 times had significantly higher vigor index as compared with the 6 times splited slips of the two variety. Even if higher vigor index by planting smooth cayenne and red spanish variety at 4 and 2 times splited slips, which was no significant vigor index with 8 times splited pineapple slips. In general, multiplying the two-pineapple variety by splitting the slips up to 8 times had an advantage to get a good quality and much of pineapple seedling from a single slip.

Keywords: *Ananas Cosmosus*, Smooth Cayenne, Red Spanish, Slips, Splitted, Seedling, Survival Count

1. Introduction

Pineapple (*Ananas cosmosus*) is botanically classified as Ananas comosus and it belongs to the bromellaceae. Its origin has been traced to Brazil and Paraguay in the Amazonic basin where the fruit was domesticated. The most probable area of origin the zone comprised from upper Panama and Brazil, Paraguay and Argentina, including the northern Amazonian Forest and the semi-arid regions of Brazil, Venezuela and Guyanas [2]. Brazil has been producing more than 40 million tons of fruits a year, ranking third in the world behind China and India. About 0.67 metric tons has been the yearly contribution of pineapples, representing about 21% of world production and placing Philippines among the second major global suppliers of this fruit [4]. It is cultivated predominantly for its fruits that can be consumed fresh or as canned fruit and juice [1]. Pineapple is the third most important tropical fruit in the world after banana and citrus [11]. and it is grown in an extensive area in

the tropics. In addition to the food value of its fruit, Pineapple leaves yield a strong, white, silky fiber that was extracted by Filipinos before 1591. Certain cultivars are grown especially for fiber production and their young fruits are removed to give the plant maximum vitality. [7].

The pineapple can be cultivated in a single cycle or in one or more additional ratoon cycles. The duration of the cycles is variable, depending on environmental conditions, vigor of planting material and the cultural practices applied. The pineapple is grown from crowns it will take up to 28 months, from the slip 24 months, and from the suckers about 16 months for the plant to flower, and it will last about two weeks. From there on, the fruit will require another 6 months to begin growing [13]. As a typical tropical species, pineapple plants show adequate growth and produce fruits of good quality when grown at air temperatures of 20 to 30°C with daily amplitude of 10 to 16°C [8, 10]. The plant is most productive and fruits are of the highest quality when solar irradiance is highest. Pineapple plants need plenty of sunshine to grow well. Grow pineapple plants in the sunniest spot in your garden. Ideally, pineapples need between six and eight hours of sunlight daily [6].

Pineapple can be grown from a shoot of the plant, crown of the fruit, slips that grown on the flower stalk and suckers that grow from underground roots. Plant materials for vegetative propagation can be in the form of shoot, slip, crown and stem cutting. Commercially pineapple has to be propagated by vegetative material, an asexual reproduction, without new combinations of genes. Some types of propagules are naturally produced by the plants and called conventional planting material. Its availability and quality depend on many factors, especially cultivar and environment [3]. Different from vegetative propagation, the generative propagation tends to be intended for breeding purposes. Pineapple can be grown from a shoot of the plant, crown of the fruit, slips that grown on the flower stalk.

The most adopted practices for the purpose of seedling multiplication are by cutting the suckers and slips of the pineapple with huge pineapple plants destruction. Slips originate from the fruit stalk below the fruit and have a characteristic curve to the base of the leaves and cutting the slips in to two times requires vast human power and is also time consuming. Multiplying the seedling with minimizing human power, time and less multiplication planting material by cutting the slips was important. So, identifying less human power and time consuming with a small number of planting material by cutting the slips is needed. In addition, this method of rapid propagation has been especially useful in two situations first to rapidly multiply new cultivars with low availability of planting material and, second, as a technique for getting planting material free of diseases disseminated by the use of contaminated slips. So, this activity was conducted: to identify the impact of number of splitted slips on development of pineapple seedlings.

2. Material and Methods

2.1. Description of Experimental Site

The potted experiment has been conducted during 2020 in the greenhouse of Wondogenet agricultural research at awada sub-center. Awada is located at 7° 192 N latitude and 38° 382 E longitude with altitude of 1780 m a. s. l. The site receives mean annual rainfall of 1128 mm with minimum and maximum temperature of 11.47 and 26.51°C, respectively. The soil textural area of the experimental area was sandy loam with the pH of 6.4 [5]. The Smooth Cayenne and Red Spanish, varieties which were adaptable to the experimental area were used as planting material.

2.2. Treatments and Experimental Procedure

The two pineapple varieties were used for the experiment. Health pineapple plant of each variety used as a source of slips for the seedling development and the knife used for slips cutting was treated with alcohol. Each treatment was composed of ten seedlings. The slips of tow pineapple varieties cutting in to 2, 4, 6, 8 times and placed on the soil filled polyethylene bag as indicated on the table. The weight and size of planting material was uniform. The stage of the pineapple at which the planting material was taken from physiologically matured plant. Here no fertilizer and chemical pesticide applied during the experimentation. All agronomic practices of the experiment were carried out uniformly whenever required.

Table 1. *Treatment combinations of pineapple varieties with number of splitted slips for the development of pineapple seedling.*

Factor A (varieties)	Factor B	combination	Treatment code
Smooth Cayenne	2 Times	2 times splitted Smooth Cayenne	T1
	4 Times	4 times splitted Smooth Cayenne	T2
	6 Times	6 times splitted Smooth Cayenne	T3
	8 Times	8 times splitted Smooth Cayenne	T4
Red Spanish	2 Times	2 times splitted Red Spanish	T5
	4 Times	4 times splitted Red Spanish	T6
	6 Times	6 times splitted Red Spanish	T7
	8 Times	8 times splitted Red Spanish	T8

The two varieties of pineapple were evaluated to different number of splitted slips under normal condition uniformly for eight months seedlings. A combination of four number of splitted slips with two pineapple varieties were evaluated using completely randomized plot design in three replications. The experiment includes 8 treatments (combination of 2

Times, 4 Times, 6 Times, 8 Times splitted slips with Smooth Cayenne and Red Spanish varieties). watering was applied during the growing period of the seedling uniformly and other cultural practices, such as weeding, was done as needed.

2.3. Data to Be Collected

At the time of data collection, the following data was taken: seedling height, leaf area index, survival count, leaves number, vigor index and dry biomass.

2.4 Statistical Data Analysis

The data recorded in this study was subjected to statistical analysis. The analysis of variance was carried out using SAS software. Significance differences between treatment means was delineated by least significance difference (LSD) test at 5% level of significance.

3. Result and Discussion

3.1. Plant Height

The longest plant recorded at the plot which contain red Spanish variety with 2 times splited slips similarly the report of [16] suckers harvested from without splitting crown were taller than those split into two and four crowns harvested from which had comparable height. and next to that planting smooth cayenne variety with 4 times splited slips and this shows the longest height as compare to the other treatment. Even if no significant difference the effects of planting 2 and 4 times splited slips on the variety of red Spanish and smooth cayenne respectively have better plant height as compare to planting 6 and 8 times splited slips. So, planting red Spanish and smooth cayenne verities by splitting up to 6 and 8 times respectively was the most advantageous from the other choice of number of slips splitting. Generally, the average plant height at red Spanish showed that the longest plant height as compare to smooth cayenne variety. According to the graph the variety smooth cayenne shows an increasing trained up to 4 times slips splitting and then decreasing trained after 4 times slips splited whereas the variety red Spanish had decreasing trained up to 6 times splited slips but after that somewhat un increasing trained but the value at 8 times slips splited was not greater than the value at 2 and 4 splited one.

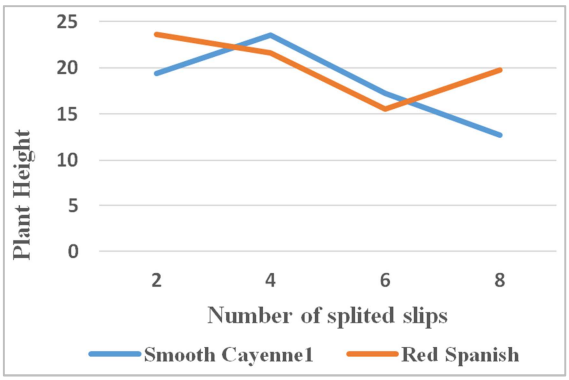

Figure 1. *Effect of number of splitted slips on seedling plant height.*

Table 2. *Mean effect of number of splitted slips on plant height, Leaf Number and Survived of pineapple seedling.*

No	Treatments	Plant height	Leaf Number
1	2 times splitted Smooth Cayenne	19.39ab	16.33a
2	4 times splitted Smooth Cayenne	23.53a	17.53a
3	6 times splitted Smooth Cayenne	17.25ab	15.00a
4	8 times splitted Smooth Cayenne	12.71b	12.53a
5	2 times splitted Red Spanish	23.61a	18.00a
6	4 times splitted Red Spanish	21.65ab	17.60a
7	6 times splitted Red Spanish	15.57ab	12.93a
8	8 times splitted Red Spanish	19.77ab	14.20a
LSD		9.21	6.02
CV		27.41	20.00
LS		NS	NS

Key: *, ** indicate significance at 0.05 and 0.01 probability levels, respectively. LSD, List Significant Difference, LS level of significancy.

3.2. Leaf Number

The analysis showed that non-significant effect on leaf number of pineapple due to the variety and number of splited slips, in a similar manner number and width of leaves were not significantly affected by the method of crown preparation [12]. In the contrary [9] who reported that the number of leaves was significantly increased by propagule weights. The highest number of leaves was recorded by planting Red Spanish variety with 2 times splited slips while the lowest number of leaves was recorded by planting Smooth Cayenne variety with 8 times splited slips. The highest number of leaves was showed by planting the variety Smooth Cayenne and Red Spanish with 4 and 2 times splited slips respectively. Similar to the plant height, the variety smooth cayenne shows an increasing trained up to 4 times slips splitting and then decreasing trained after 4 times slips splited whereas the variety red Spanish had decreasing trained up to 6 times splited slips but after that somewhat un increasing trained. However, the value at 8 times slips splited was not significant difference than the value at 2 and 4 splited one.

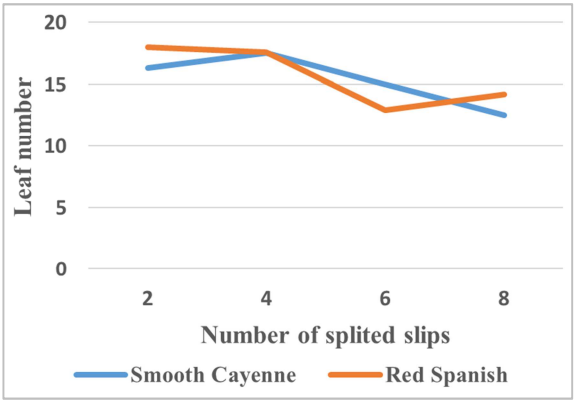

Figure 2. *Effect of number of splitted slips on seedling Leaf number.*

3.3. Dry Biomass

Significantly the highest and the lowest yield of dry biomass were recorded by planting red spanish variety with 2 times slips splited (23.42 gm/plant) and 6 times splitted slips (10.73 gm/plant) respectively, similarly [14] who reported that the highest cutting size of pineapple stem gave the highest total shoot weight and [9] also reported Heavy weight (40-45g) stumps produced the highest number of pineapple plantlets compared to the least produced by light weight stump and plantlet biomass. He also concludes that the decreased biomass weight in this study was probably due to the reduction of the number of leaves and components of the leaf, which eventually resulted in poor overall plant biomass, since the leaf is the major source of carbohydrates required for growth. The variety red spanish have a greater average biomass production as compared to the variety of Smooth Cayenne as affected by number of splited slips of pineapple. According to a single plant data the variety of Smooth Cayenne shows slightly influenced due to the number of splited slips than the variety of red spanish. Planting the two variety by spliting the pineapple slips in 8 times had no significant difference of seedling dry biomass as compared to the other number of slips spliting. This had a good contribution to multiply more seedlings by spliting a single slip in to 8 times rather than 2, 4 and 6 times. Even if higher dry biomass production by planting smooth cayenne and red spanish variety at 4 and 2 times splited slips, there was no significant dry biomass production with 8 times splited pineapple slips.

Table 3. *Mean effect of number of splitted slips on leaf area, % emergency, dry biomass and Vigor Index of pineapple seedling.*

No	Treatments	Leaf Area Index	% Emergency	Dry Biomass per plant (gm)	Vigor Index
1	2 times splitted Smooth Cayenne	27.19a	86.67a	21.12a	182.77ab
2	4 times splitted Smooth Cayenne	28.57a	76.67a	21.87a	215.16a
3	6 times splitted Smooth Cayenne	23.13ab	76.67a	12bc	100.09b
4	8 times splitted Smooth Cayenne	12.96b	63.33a	18.66abc	153.27ab
5	2 times splitted Red Spanish	29.92a	93.33a	23.42a	234.17a
6	4 times splitted Red Spanish	26.65a	83.33a	21.74a	202.9a
7	6 times splitted Red Spanish	20.91ab	73.33a	10.73c	100.29b
8	8 times splitted Red Spanish	27.21a	80a	21.04ab	157.71ab
LSD		8.72	35.13	11.89	86.25
CV		20.28	25.34	26.63	29.27
LS		0.0085	NS	0.0481	0.034

Key: *, ** indicate significance at 0.05 and 0.01 probability levels, respectively. LSD, List Significant Difference, LS level of significancy.

3.4. Leaf Area Index

Table 4. *Interaction effects of varieties and number of splited slips on Seedling Survival count and Leaf area Index of pineapple.*

Variety	Number of splited slips				
	2	4	6	8	Mean
	Seedling Survival count (%)				
Smooth Cayenne	83.33ab	96.67a	83.33ab	66.67b	82.50
Red Spanish	100.00a	86.67ab	80.00ab	80.00ab	86.67
LSD	10.47				
CV%	7.065				
VR*ST	**				
	Leaf area Index				
Smooth Cayenne	27.19a	28.573a	23.133ab	12.963b	22.96
Red Spanish	29.92a	26.65a	20.91ab	27.207a	26.19
LSD	8.72				
CV%	20.275				
VR*ST	*				

The interaction effect of pineapple variety and number of splited slips significantly ($P<0.05$) affected the leaf area index (Table 4). The results were not consistent trained in the two-pineapple variety with increasing the number of slips splitting. This result also consistence with [9] who reported that leaf area was significantly increased with increasing propagule weights. The highest leaf area index was obtained at the combination of red spanish with 2 times splited slips.

The lowest leaf area index obtained from the combination of smooth cayenne with 8 times splited slips. The influence of treatment on leaf area showed that plantlets developed from check crowns had largest leaf area in all media followed by the half and one quarter split crowns and least in all other propagules irrespective of the potting substrate used [16]. The average mean leaf area index of pineapple seedling grown by four number of splited slips showed that the highest red spanish leaf area index recorded by the slip spliting at 2 times followed smooth cayenne by 4 time splited slip. The lowest leaf area index recorded by the variety smooth cayenne splited the slips 8 times which was lower by 43.33% from the variety red Spanish splited the slips 2 times. On the other hand, the average mean leaf area index of pineapple variety due to the number of slips splited showed that the variety red spanish ranked higher from the variety smooth cayenne.

3.5. Survival Count

The analysis of variance indicated significant ($P<0.05$) interaction effects of pineapple variety and number of slips splited on the seedling survival count. Slips splitting in to different number did not show consistent trends in terms of affecting seedling survival of smooth cayenne than red Spanish variety, similarly [16] reported that the trend of survival and establishment of the suckers in the different potting substrates may indicate that sucker size influenced its survival more than the type of the potting substrate in which they were nursed. However, the highest number of survived seedlings (100%) were counted by planting red spanish variety with 2 times splited slips which have significant survival difference with planting smooth cayenne slips splited 8 times (66.67%). The high mortality rate in the 1/8 sucker size might be attributed to the limited nutrient reserves in these materials, necessitating prolonged and careful handling in the nursery to ensure their survival [16] On the other hand, the variety of red spanish have a greater capacity to survive even as compared to the variety of smooth cayenne. Even if there was no great difference the variety of smooth cayenne was more influenced by the number of slips splited than the variety of red Spanish.

3.6. Vigor Index

The seedlings grown from the spliting of red Spanish slips at 2 times had significantly higher vigor index as compared with the 6 times splited slips of the two varieties, similarly [17] reported that heavy planting material resulted in more vigorous plants than light planting material at the farmers' flowering induction time. This result is also consistent with [15] who reported that the amounts of starch reserve in the pieces, the amount of leaf material present and freshness of the piece of material have significant effects on growth of the plants. But planting the two variety by spliting the pineapple slips in 8 times had no significant difference of seedling vigor index as compared to the other number of slips spliting. This had a good contribution to multiply more seedlings by spliting a single slip in to 8 times rather than 2, 4 and 6 times. Even if higher vigor index by planting smooth cayenne and red spanish variety at 4 and 2 times splited slips, which was no significant vigor index with 8 times splited pineapple slips. According to the vigor index data the variety of Smooth Cayenne shows slightly influenced due to the number of splited slips than the variety of red spanish. The variety red spanish have a greater average vigor index as compared to the variety of Smooth Cayenne as affected by number of splited slips of pineapple.

4. Conclusion

Even if no significant difference the effects of splitting the pineapple 2 and 4 times on the variety red spanish and smooth cayenne have better plant height and leaf number as compare to splitting the slips in to 6 and 8 times. Significantly the highest and the lowest yield of dry biomass were recorded by planting red spanish variety with 2 times slips splited (23.42 gm/plant) and 6 times splitted slips (10.73 gm/plant) respectively. The interaction effect of pineapple variety and number of splited slips significantly ($P<0.05$) affected the leaf area index (Table 4). The highest leaf area index was obtained at the combination of red spanish with 2 times splited slips. The lowest leaf area index obtained from the combination of smooth cayenne with 8 times splited slips. The analysis of variance indicated significant ($P<0.05$) interaction effects of pineapple variety and number of slips splited on seedling survival count. Slips splitting in to different number did not show consistent trends in terms of affecting seedling survival and relatively smooth cayenne somewhat affected than red Spanish variety. However, the highest number of survived seedlings (100%) were counted by planting red spanish variety with 2 times splited slips which have significant survival difference with planting smooth cayenne slips splited 8 times (66.67%). On the other hand, the vogor index of pineapple due to splitting the slips in to different number and its variety shows a significant difference. But planting the two variety by spliting the slips in 8 times had no significant difference of seedling vigor index as compared to the other number of slips spliting. Even if maximum vigor index by planting smooth cayenne and red spanish variety at 4 and 2 times splited slips respectively, there was no significant vigor index with 8 times splited pineapple slips.

In conclusion splitting the pineapple slips of red spanish and smooth cayenne variety in to 2 and 4 times respectively had good effect in all physical parameters. The above listed parameters at 6 and 8 times slip splitting had small increment but more parameters had no significant difference in value of 8 times splited slips. So, splitting the pineapple slips up to 8 time for smooth cayenne and red spanish variety contribute for a good pineapple seedling multiplication. This practice helps the farmers to save their human power, money for labor and reduce the destruction of pineapple farms for seedling multiplication.

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Conflict of Interest

The authors declare no conflict of interest.

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