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KUDAN, EFRAIM JR. O. MAY 2013. Growth and Yield of Melon Pear Propagated through Different Parts of Stem Cuttings under Plastic Tunnel Condition. Benguet State University, La Trinidad, Benguet

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ABSTRACT

The melon pear or pepino dulce meaning “sweet pepino” is the fruit of *Solanum muricatum*, a species of a shrub in the flowering plant family Solanaceae. This fruit resembles a melon fruit in color, and its flavor recalls a succulent mixture of honey dew and cucumber.

The study is important to future researchers, as it provides appropriate information in the research regarding melon pear. The results serve as a guide to those who are interested to venture in melon pear production with hopes to extend it to the community to promote the production of this commodity as one of the major fruit crops that can be produced in their area.

The study was conducted at the BSU Organic Farm, Benguet State University, La Trinidad Benguet, from October 2012 until April 2013 to determine the effect of different parts of stem cuttings as planting materials on the growth and yield of melon pear, and to determine the profitability of growing melon pear through stem cuttings under La Trinidad condition.

Results of the study revealed that Melon pear propagated through cuttings taken from the shoot tips of the stem had formed new leaves significantly earlier, and had the highest average number of leaves per plant. On the other hand, cuttings from the middle portion on the stem and the base portion had rooted earlier, and cuttings from the base portion of the stem had the longest roots. More number of roots were formed and longer shoots were measured from cuttings obtained from the base portion of the stem as well as those from the middle portion of the stem.

The shoot tip cuttings were the earliest to form flower buds, the earliest to set fruit, to ripen and harvested this is two months from transplanting. Plants obtained from cuttings from the middle portion of the stem took three months to have ripened fruits. Cuttings obtained from the base portion of the stem took three to four months to have ripened fruits. The morphological characteristics of the fruits were not significantly different among treatments. Likewise, the average numbers of harvested fruits per plot were not significantly different among the treatments.

As to the profitability, the use of shoot tip cuttings as planting materials resulted in a positive return on investment of 11.74 % or 11 centavos for every peso invested in production. Using cuttings obtained from the middle portion and from the base portion of the stem as planting materials both resulted in negative return on investment of -12.28 % and - 4.90% ; respectively.

RESULTS AND DISCUSSION

Days From Planting to Root Formation

Table 1 shows the number of days from planting of different kinds of stem cuttings of melon pear to root formation. Cuttings taken from the base portion of the stem were the earliest to form roots with a mean of 5.50 days. This shows a significant difference between the shoot tip cuttings that had a mean of 6.90 days, and the middle portion cuttings that had a mean of 6.40 days.

Melon pear plant was observed to have the ability to form adventitious roots, especially in the base portion of the plant. It was also observed that lateral stems near the ground have the ability to form root initials. In some plants adventitious root initials are formed even during the early stage of stem development. Few of which were already present at the time the cuttings were made. These are termed *preformed,* or *latent, root initials* and generally lie dormant until the stems are made into cuttings and placed under environmental conditions favorable for the emergence of the primordial as adventitious roots (Hartmann and Kester, 1975).

Table 1. Days from planting to root formation

TREATMENT	MEAN (Days)
Shoot tip cuttings	6.90[a]
Middle portion cuttings	6.40[a]
Base portion cuttings	5.50[b]
CV (%)	5.83

Means with a common letter are not significantly different at 5% level DMRT

Figure 3.Root formation of cuttings taken from different portion of the stem

Root Length (cm) 60 Days from Planting

Results in Table 2, shows that there were significant differences among the treatments with respect to root elongation. The base portion cuttings having the longest roots developed with a mean of 30.93 cm followed by the middle portion cuttings that has a mean of 28.04 cm, and the shoot tip cuttings having the shortest with a mean of 23.51 cm; 60 days from sticking of the cutting in the plots .

The earlier formation of roots is apparent on the base stem cuttings. The early formation of roots on the base portion cuttingsconsequently resulted to a more elongated roots as compared to the other treatments (cuttings).

Table 2. Root length (cm) 60 days from planting

TREATMENT	MEAN
Shoot tip cuttings	23.51[c]
Middle portion cuttings	28.04[b]
Base portion cuttings	30.93[a]
CV (%)	6.31

Means with a common letter are not significantly different at 5% level DMRT

Number of Roots Per Cutting

There were significant differences in the average number of roots per cutting among the different kinds of stem cuttings as shown in Table 3. The middle portion and base portion cuttings had higher root number with 9.95 and 10.65 respectively, although it was not statistically significant. However, these were significantly different from that of the shoot tip cuttings that had a lower mean of 6.90 roots only.

The results show that mature stems have faster root formation and there are more root initials that were present on the stem where roots were formed.

Table 3. Number of roots per cutting

TREATMENT	MEAN
Shoot tip cuttings	6.90[b]
Middle portion cuttings	9.95[a]
Base portion cuttings	10.65[a]
CV (%)	7.50

Means with a common letter are not significantly different at 5% level DMRT

Percentage Survival

The melon pear propagated through cuttings taken from different portions of the stem, namely shoot tip cuttings, middle portion cuttings, and base portion cuttings have survived and reached maturity, giving 100 % percentage survival rate.

Days from Planting to First Appearance of Leaves

Melon pear propagated through shoot tip cuttings were the earliest to have appearance of new leaves with a mean of 24.50 days compared to that of the middle portion cuttings with a mean of 24.80 days and base portion cuttings having a mean of 25.00 days from planting.

The results seen in Table 4 show no significant differences as far as the duration from planting to the first appearance of leaves. The findings show that the portion in the stem on which the cuttings were taken did not affect the initiation of leaf buds, where leaves were formed.

Number of Leaves Per Plant

Table 5 shows the effect of the kind of stem cuttings on the number of leaves that

Table 4. Days from planting to first appearance of leaves

TREATMENT	MEAN
Shoot tip cuttings	24.50[a]
Middle portion cuttings	24.80[a]
Base portion cuttings	25.00[a]
CV (%)	2.58

Means with a common letter are not significantly different at 5% level DMRT

Table 5. Number of leaves per plant

TREATMENT	MEAN
Shoot tip cuttings	31.35[a]
Middle portion cuttings	26.75[b]
Base portion cuttings	26.20[b]
CV (%)	6.00

Means with a common letter are not significantly different at 5% level DMRT

developed per plant. Significant differences were obtained between the shoot tip cuttings that has a mean of 31.35 leaves; to that of the middle portion and base portion cutting. However, there were no significant differences between the middle portion and base portion cutting which has a mean of 26.75 and 26.20 leaves; respectively; two months from planting.

Shoot Length (cm) 60 days From Planting

Table 6 shows the effect of the kind of stem cuttings on the length of the shoots of melon pear 60 days after planting. The shoot length of the middle portion cuttings with a mean of 37.67 cm has no significant differences with those of the base portion cuttings with a mean of 37.94 cm. However, significant differences were noted between the middle portion and base portion cuttings to that of the shoot tip cuttings which had a mean of 35.12 cm.

This is in contrast to what is common when planting stem cuttings, where it is expected that the shoot tip cuttings normally has the longest shoot as compared to any portion of the same stem.

Table 6. Shoot Length (cm) 60 days from planting

TREATMENT	MEAN
Shoot tip cuttings	35.12[b]
Middle portion cuttings	37.67[a]
Base portion cuttings	37.94[a]
CV (%)	1.18

Means with a common letter are not significantly different at 5% level DMRT

Days from Planting to Flower Bud Formation

The number of days from planting to first flower emergence is shown in Table 7. There were significant differences among the treatments with the shoot tip cuttings having the least number of days to flowering with flower buds noted after a mean of 33.25 days from planting. This was followed by the middle portion cuttings with a mean of 35.85 days, and the base portion cuttings which had the longest period to form flowers buds with a mean of 46.73 days. Results show that reproductive organs develop faster in shoot tip cuttings.

Table 7. Days from planting to flower bud formation

TREATMENT	MEAN
Shoot tip cuttings	33.25[c]
Middle portion cuttings	35.85[b]
Base portion cuttings	46.73[a]
CV (%)	1.52

Means with a common letter are not significantly different at 5% level DMRT

The results show that flower buds were already present in the shoot tip cuttings and upon recovery, prior to planting, the flowers emerged. Whereas, the middle portion and base portion cuttings needs a longer period of time to develop new shoots where flower buds will develop.

Figure 4. Melon pear plants with the first flowers

Figure 5. Close-up photograph of melon pear flower taken at first flowering

Number of Flowers Per Plant

Table 8 shows the effect of the kind of stem cuttings on the number of flowers that developed.

Table 8. Number of flowers per plant

TREATMENT	MEAN
Shoot tip cuttings	29.85[a]
Middle portion cuttings	32.85[a]
Base portion cuttings	31.50[a]
CV (%)	5.29

Means with a common letter are not significantly different at 5% level DMRT

The middle portion cuttings had the highest number of flowers that developed with a mean of 32.85 flowers per plant followed by the base portion cuttings with a mean of 31.50 flowers per plant, while the shoot tip cuttings had the lowest number of flowers that developed with a mean of 29.85 flowers per plant. Statistical analysis, however did not show significant differences among the different treatments.

Days From Flowering to First Fruit Development

Results show that the shoot tip cuttings had the fastest fruit development with a mean of 31.80 days from flowering, followed by the middle portion cuttings with a mean of 36.43 days, and the base portion cuttings having the longest period to first fruit development with a mean of 40.13 days. These results show significant differences among the treatments as seen in Table 9.

The shoot tip cuttings had earlier fruit development apparent due to its earlier flower formation. Whereas, the middle portion and base portion stem cuttings needed longer time for the newly developed flowers to set fruits and to have fruit development.

Table 9. Days from flowering to first fruit development

TREATMENT	MEAN
Shoot tip cuttings	31.80[c]
Middle portion cuttings	36.43[b]
Base portion cuttings	40.13[a]
CV (%)	1.25

Means with a common letter are not significantly different at 5% level DMRT

Number of Fruits Per Plant

Table 10 shows the effect of the portion of stem cuttings to the number of fruits that developed per plant. With a mean of 5.96 fruits per plant, the shoot tip cuttings have the highest number of fruits developed followed by middle portion and the base portion stem cuttings with a mean of 5.74 and 5.01 respectively.

Results show significant differences among the treatments, although numerically, these differences are minimal.

The differences in the number of fruits developed may have been attributed to the pre-established reproductive organs (flower buds) in the shoot tip cuttings. The melon pear propagated through the shoot tip cuttings developed more well established reproductive organs. While the middle portion cuttings and base portion cuttings were observed to have more flowers that did not develop well and fell off. Thus, more fruits were successfully developed from plants propagated through shoot tip cuttings. However, the differences in the number of fruits were minimal because the middle portion and base portion cuttings had developed more laterals where more flowers had developed.

Table 10. Number of fruits per plant

TREATMENT	MEAN
Shoot tip cuttings	5.96[a]
Middle portion cuttings	5.74[ab]
Base portion cuttings	5.01[b]
CV (%)	7.66

Means with a common letter are not significantly different at 5% level DMRT

Percentage Fruit Set(%)

The results in percentage fruit set show significant differences between the shoot tip cuttings (with a mean of 19.98%)compared to that of the middle portion stem cuttings with a mean of 17.44% and the base portion stem cuttings with a mean of 15.97%. Statistical analysis however, shows that the middle portion stem cuttings and base portion stem cuttings has no significant difference. Table 11 shows the percentage fruit set among the different stem cuttings.

The differences in the percentage fruit set may have been attributed to the differences in the number of fruits that emerged and the number of fruits that developed among the treatments.Plants propagated through shoot tip cuttings had the least number of flowers that emerged, however it had the most number of fruits that developed. Thus, it had a higher percentage fruit set compared to the other treatments. The middle portion cuttings and base portion cuttings had a higher number of flowers that emerged, however; there were lesser number of fruits that developed. Thus, these two kinds of cuttings posted a lower percentage of fruit set.

Table 11. Percentage fruit set (%)

TREATMENT	MEAN
Shoot tip cuttings	19.98[a]
Middle portion cuttings	17.44[b]
Base portion cuttings	15.97[b]
CV (%)	6.55

Means with a common letter are not significantly different at 5% level DMRT

a) Melon pear fruits that developed from shoot tip cuttings before and upon ripening

b) Fruits that developed from the middle portion cuttings before (near) and upon ripening

c) Fruits that developed from the base portion cuttings before and upon ripening

Figure 6. Fruits that developed from cuttings taken from different parts of the stem

Days from Fruit Set to Maturity and Harvest

Table 12 shows the effect of the portion of stem where cuttings were obtained on the number of days from fruit set to maturity and harvest. Plants propagated through shoot tip cuttings are the earliest to mature, with a mean of 52.80, followed by the middle portion cutting with a mean of 63.43 days. The fruits from the base portion cuttings had the longest number of days with a mean of 71.15 days.

The results show significant differences among the three kinds of cuttings. As expected, shoot tip cuttings that had developed flowers earlier had earlier fruit development and maturity. Moreover, the middle portion and base portion cuttings took longer duration to form flower bud thus, had also took a longer period for the fruit to develop and mature.

Total Number of Harvested Fruits

Table 13 shows the effect of the kind of stem cuttings on the number of harvested fruits. Numerically, the shoot tip cuttings had the highest number of harvested fruits with a mean of 4.88 fruits per plot, followed by the plants grown from middle portion

Table 12. Days from fruit set to maturity and harvest

TREATMENT	MEAN
Shoot tip cuttings	52.80[c]
Middle portion cuttings	63.43[b]
Base portion cuttings	71.15[a]
CV (%)	0.74

Means with a common letter are not significantly different at 5% level DMRT

a) Harvested fruits from melon pear plants propagated through shoot tip cuttings

b) Harvested fruits from melon pear plants propagated through the middle portion cuttings.

c) Harvested fruits from melon pear plants propagated through base portion cuttings

Figure 7. Harvested fruitsmeasured, weighed and extracted

Table 13. Total number of harvested fruits

TREATMENT	MEAN
Shoot tip cuttings	4.88[a]
Middle portion cuttings	4.85[a]
Base portion cuttings	4.70[a]
CV (%)	4.23

Means with a common letter are not significantly different at 5% level DMRT

cuttings with a mean of 4.85 fruits, while the base portion cuttings, had the lowest mean of 4.70 fruits.Statistical analysis however, did not show significant differences among the treatments with respect to number of fruits that were harvested.

Length of Fruits (cm)

Table 14 shows the effect of the kind of stem cuttings on fruit length. Plants propagated through the base portion cuttings had the longest fruits with a mean of 9.11cm., followed by the shoot tip cuttings with a mean of 9.01 cm., and the middle portion cuttings developed the shortest fruits with a mean of 8.34 cm.

Table 14. Length of fruits (cm)

TREATMENT	MEAN
Shoot tip cuttings	9.01[a]
Middle portion cuttings	8.34[a]
Base portion cuttings	9.11[a]
CV (%)	7.79

Means with a common letter are not significantly different at 5% level DMRT

Numerically, slight differences in the length of fruits were observed. However, statistical analysis shows no significant difference among the treatments.

Width of Fruits (cm)

Table15 shows the effect of the kind of stem cuttings on the width of the melon pear fruits. Plants propagated through themiddle portion cuttings developed wider fruits with a mean of 7.00 cm., followed by the base portion cutting with a mean of 6.87 cm., andthe shoot tip cuttings had the smallest fruits with a mean of 6.63 cm.

Statistical analysis however, did not show significant differences among the treatments with respect to the width of the fruits.

Weight of Fruits Harvested (g)

Table 16 shows the effect of the kind of stem cuttings on the weight of the melon pear fruits. Statistical analysis did not show significant differences among the treatments.

Numerically, however, propagated plants through shoot tip cuttings have developed the heaviest fruits with a mean of 214.12 g., followed by the base portion

Table 15. Width of fruits (cm)

TREATMENT	MEAN
Shoot tip cuttings	6.63[a]
Middle portion cuttings	7.00[a]
Base portion cuttings	6.87[a]
CV (%)	9.87

Means with a common letter are not significantly different at 5% level DMRT

Table 16. Weight of fruits harvested (g)

TREATMENT	MEAN
Shoot tip cuttings	214.12[a]
Middle portion cuttings	184.48[a]
Base portion cuttings	209.16[a]
CV (%)	20.21

Means with a common letter are not significantly different at 5% level DMRT

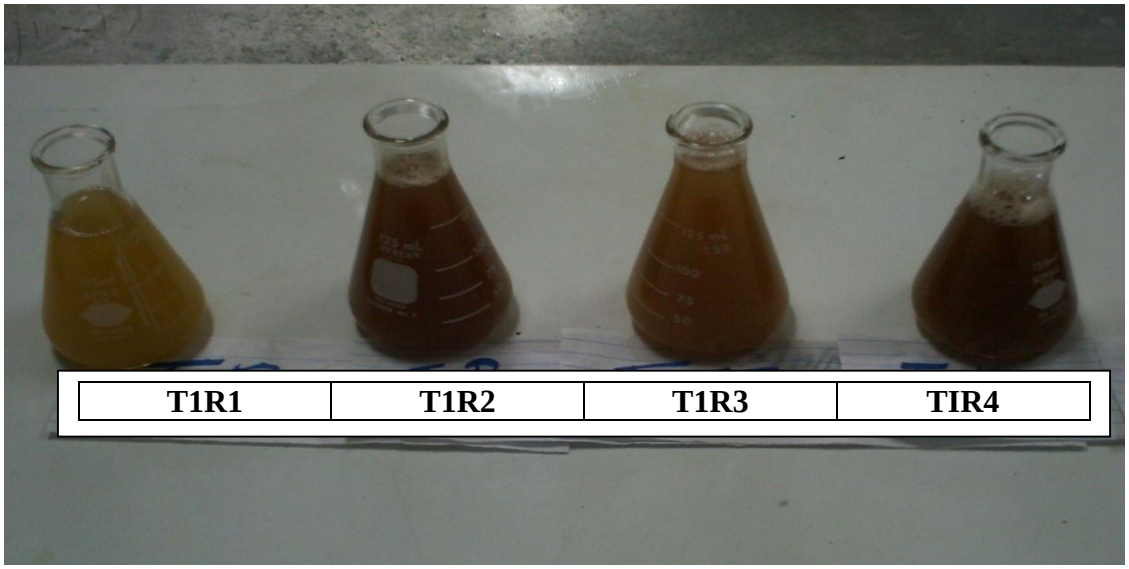
cuttings with a mean of 209.16g, and fruits that developed from the middle portion cuttings werethe lightest with a mean of 184.48 g.

Sugar Content of Fruits (% Brix)

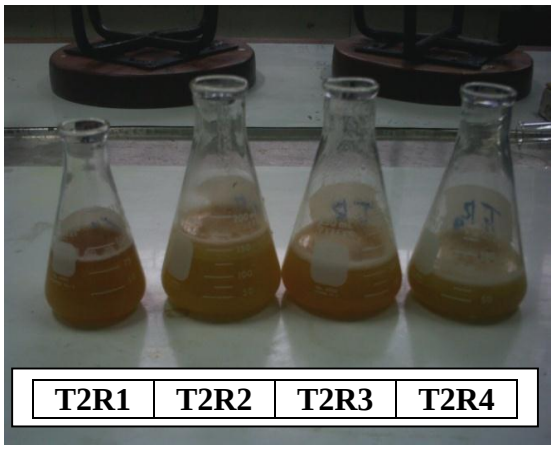
Table 17 shows the effect of the kind of stem cuttings on the sugar content of melon pear fruits. Statistical analysis did not show significant differences among the treatments with respect to the sugar content of the fruit.

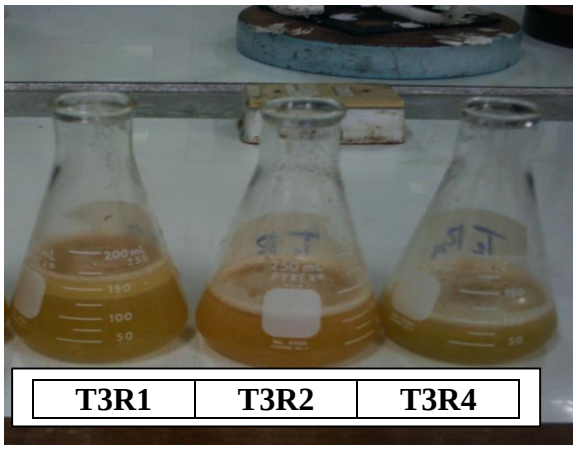
Numerically, however, plants propagated through the middle portion stem cuttingsdeveloped fruits with the highest sugar content averaging to 5.33 %, followed by the base portion stem cuttings with a mean of 5.22 %, and the shoot tip cuttings had the lowest mean of 5.21 %.

The low percentage in the sugar content of the fruit may bedue to its high amount of water content. Thus, in regions where it is propagated, it is often used as fresh snack, or refreshments for its delicate and mild flavor (Popenoe, 1989).



a) Juice extracts from harvested fruit of melon pear propagated through shoot tip cuttings





b) Juice extracts of harvested fruits (Middle portion)

c) Juice extracts of harvested fruits (Base portion)

Figure 8.Extracts of melon pear fruits used for sugar content and total soluble solids analysis

Table 17. Sugar content of fruits (% Brix)

TREATMENT	MEAN
Shoot tip cuttings	5.21[a]
Middle portion cuttings	5.33[a]
Base portion cuttings	5.22[a]
CV (%)	2.74

Means with a common letter are not significantly different at 5% level DMRT

Total Soluble Solids of Fruits

Table 18 shows the effect of the portion of stem cuttings on the total soluble solids of melon pear fruits. Statistical analysis did not show significant difference among the treatments with respect to the total soluble solids of the fruit.

Numerically however, fruits developed from the shoot tip cuttings had the highest total soluble solidswith a mean of 4.62, followed by the middle portion stem cuttings with a mean of 4.42, while the base portion stem cuttings developed fruits with the lowest

Table 18. Total soluble solids of fruits

TREATMENT	MEAN
Shoot tip cuttings	4.62[a]
Middle portion cuttings	4.42[a]
Base portion cuttings	4.24[a]
CV (%)	15.75

Means with a common letter are not significantly different at 5% level DMRT

mean of 4.24. The low amount of total soluble solids in the melon pear may be due to its high amount of water content of the fruit which could also be attributed to the inherent characteristic of the plant.

Cost and Return Analysis

The cost and return analysis on Table 19 shows that the melon pear propagated through shoot tip cuttings have a net profit of 38.617 Php, while the other two types of cuttings have a negative net profit, with the base portion stem cuttings with -87.09 Php, and the middle portion giving the lesser net profit of -139.53 Php.

Results show that the plants propagated through shoot tip cutting has the only positive return on investment (ROI) of 11.74 %, while the other cuttings gave a negative value on the ROI with the base portion cuttings with -4.90% while the middle portion cutting with a mean of -12.28 %.

These observations show that melon pear plants propagated through stem cuttings posts the highest return on investment with a positive result. While the middle portion and base portion cuttings results to negative ROI.

Table 19.Cost and return analysis

PARTICULAR	CULTIVARS		
	Shoot tip cuttings	Middle portion cuttings	Base portion cuttings
Yield (kg)	10.554	8.285	8.983
Gross Sales (Php)	844.32	666.20	718.64
Expenses			
Polytunnel plastic	43.33	43.33	43.33
Bamboo strips	150.00	150.00	150.00
Tractor	50.00	50.00	50.00
Irrigation	78.00	78.00	78.00
Labor cost			
Plot preparation	83.33	83.33	83.33
Compost application	5.21	5.21	5.21
Irrigation	104.17	104.17	104.17
Hilling up	20.83	20.83	20.83
Plastic tunnel preparation and set up	125	125	125
Weeding	52.083	52.083	52.083
Planting material preparation	10.42	10.42	10.42
Harvesting	83.33	83.33	83.33
Total expenses (Php)	805.703	805.703	805.703
Net profit	38.617	-139.53	-87.09
ROI (%)	11.74	-12.28	-4.90

Note: Selling price per kilo of Melon pear was 80.00 Php at BSU Organic Market

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at the BSU Organic Farm, Benguet State University, La Trinidad Benguet, from October 2012 until April 2013 to determine the effect of propagating melon pear through different parts of stem cuttings on the growth and yield of melon pear, determine the part of the stem that has the highest rate of growth and yield, and to determine the profitability of growing melon pear through stem cuttings under La Trinidad condition.

Results of the study revealed that Melon pear propagated through cuttings taken from the shoot tips of the stem had earlier formation of new leaves with a mean of 25.5 days, had the highest average number of leaves developed per plant with 31.35. On the other hand, the middle portion and base portion cuttings have earlier root development; with a mean of 5.5 days from planting developed the longest roots with a mean of 30.93 cm. With more number of roots formed and longer shoots were also observed in the base portion and middle portion cuttings.

In terms of flowers and fruit development, the shoot tip cuttings were the earliest to develop flower as well as fruits which ripened and harvested in about two months from planting. While the middle portion stem cuttings took three months for its fruits to ripen. The base portion stem cuttings took three to four months for fruits to ripen. The morphological characteristics of the fruits were not significantly different, in terms of itslength, width, weight, sugar content and total soluble solids as well as the total number of fruits harvested.

As to profitability, the shoot tip cuttings obtained a positive return on investment (ROI) of 11.74 % or 0.1174 Php for every peso invested in production, while the middle portion and base portion cuttings, both posting negative return on investment of-12.28 % and -4.90%, respectively.

Conclusion

Based on the results of the study, melon pears propagated through shoot tip cuttings have earlier development of reproductive organs. Thus, fruits matured at a faster rate and were harvested earlier. Moreover, harvested fruits gave the highest profit and a positive return on investment. However, earlier root formation and longer roots were obtained from cuttings taken from the middle and base portions of the stem.

Recommendation

Based on the forgoing results, it is recommended that Melon pear cuttings should be taken from the shoot tips to obtain earlier fruit development and higher profit. It is further recommended that the results should be verified by planting melon pear cuttings under field conditions.

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