BIBLIOGRAPHY

LIM, GENIFER L. APRIL 2012. Growth and Yield of Sweetpotato Cultivars Using the Different Vine Parts as Planting Materials in Bagulin, La Union. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

This study was conducted to determine the growth and yield of the different sweetpotato varieties; determine the best vine parts as planting materials for sweetpotato varieties; determine the growth and yield of sweetpotato varieties using the different vine parts as planting materials and to determine the profitability of sweetpotato using different vine parts.

Result showed that the use of sweetpotato tip vine as planting materials had the highest survival, total yield and computed yield. In terms of herbage yield and vine length, the middle vine part can be used.

Among the varieties, Violet had the highest yield and ROCE. Most of the varieties are moderately resistant to beetles and cutworm infestation and scab infection. For herbage production, In-metlog using the basal part as planting material could be used. Lowest yield and ROCE was recorded in Murado and in using the basal vine part as planting material.

INTRODUCTION

Sweetpotato is a spreading and prostate herbaceous plant, extensively grown throughout the Philippines, a native of tropical America and is cultivated most in warm countries. However, some varieties are grown in the mild cold parts of Cordillera as per survey made by NPRCRTC (1991).

Sweetpotato is one of the most important food crop in the Philippines. Nationwide, sweet potato ranked eight among agricultural crops in terms of total production and 10th in area harvested.

Sweetpotato is generally grown in less fertile soil such as those in sandy coastal areas where there are mine tailing, lahar and acidic soil of hillsides. It also thrives in drought prone areas.

Vine or stem cutting is commonly used as planting materials in sweetpotato production. It is usually hardened for two to three days to induce and to enhance rooting. Hardening is done by storing apical cuttings under a cool moist and shady place for a number of days prior to planting.

In the Philippines, sweetpotato is planted using stem cuttings. Farmers obtain cuttings from any parts of the vine before or right after harvest of roots. The vines are either used to establish a maintenance field directly for planting of the next sweet potato crop (PCARRD, 2000). Apical shoots are the best planting materials although other parts of the vine maybe used.

Major crops planted by farmers in Bagulin, La Union are sweetpotato, tiger grass and rice. The farmers generally use the apical shoots as planting materials. This practice leads to scarcity of planting materials that would even limit the sweetpotato production.

Therefore, further studies on the different vine parts of sweetpotato as source of planting materials should be done.

The study aimed to:

1. determine the growth and yield of the different sweetpotato varieties in Bagulin, La Union;

2. determine the best vine part as planting material for the sweetpotato varieties;

3. determine the growth and yield of sweetpotato varieties using the different vine parts as planting materials; and

4. determine the profitability of sweetpotato using different vine parts.

The study was conducted at Cambaly, Bagulin, La Union from September 2011 to January 2011.

REVIEW OF LITERATURE

The Plant

Sweetpotato is an herbaceous and perennial plant. However it is grown as an annual plant by vegetative propagation using either storage roots or stem cuttings. Its growth habit is predominantly prostate with a vines system that expands rapidly horizontally on the ground. The growth habit of sweetpotato are erect, semi-erect, spreading and very spreading.

Sweet Potato Propagation

Sweetpotato for seed usually is grown from vine cuttings. These cuttings are also used for the late planting especially in the South. Cuttings are taken from the plants as soon as the vines start to run; 8m to 12 inch section of vine are pushed into the soil at desired intervals. Vine cutting are cheaper than sprouts and less likely to spread diseases, but their use delay planting .One arc of plant will supply cutting for eight acres of crop (Martin *et al*., 1976).

PCARRD (2000) stated that sweetpotato cuttings planted right after harvesting and those planted after harvesting and those planted after storing for one to two days yielded significantly higher than the rest of the treatment. It gave a linear regression of yield from 22.92 t/ha when planted right after harvesting and 14.58 t/ha when storage was extended to six days. The number and length of roots were significantly more. However the roots produced did not vary in diameter.

The different propagating materials had marked effect on the growth and yield of sweet potato. Tip and stem cuttings gave the highest yield and the biggest and heaviest roots; Sweetpotato from roots and tips produced long, slender and deep penetrating roots; and cutting from slips tend to encourage vine trailing and produced numerous but small roots (Pamogas, 1982).

Dalang, *et al* (1989) stated that vine storage for up to 9 days does not affect root yield of local sweet potato cultivar kalbo-oy. Storing the vines for 12 to 21 days significantly affected survival and root yield.

Further, Dalang, *et al* (1990) also stated that the survival rate as well as herbage and root yield component of sweetpotato grown from the tip, middle and basal cuttings were not significantly different. On the other hand, middle cuttings of cv. Kalbo-oy gave relatively high returns of PhP 12,853 ⁄ ha compared to those from tip and basal cutting, with PhP 7,272 and PhP 4,080, respectively.

As cited by PCARRD (2000) the length of cutting may or may not affect the yield depending on the cultivar and number of the nodes. It was reported that the number of the nodes in Georgia Red did not influence the yield although yield tended to increase for both dry and wet season as the number of buried nodes increased from four to eight. Similar result were obtain by other studies except hat during the dry season, the 14- nodes and seven nodes buried cutting gave a higher yield. The longer are known to be better than short cutting provided that the number of buried nodes is similar. From which part of the vine the planting material is taken, affects yield. Generally the apical portion is better than the middle or basal portion, Although the advantage of the apical cutting is lost when stored before planting.

Faroden (2008) Also stated that middle vine cuttings in yam has the highest percentage of tuberlets produced with 73% followed by basal vine cutting with 55% and tip vine cuttings.

Among the different vine parts, the middle vine cutting has better performance in terms of tuberlet production followed by tip and basal vine cutting.

MATERIALS AND METHODS

An area of 180 m^2 was properly cleaned and prepared. The area was divided into three blocks consisting of 12 plots each measuring 1m x 5m. The experiment was laid-out in a 3 x 4 factor factorial in Randomized Complete Block Design (Figure 1).

Sweetpotato vines were prepared with 30 cm per planting material from different varieties. One cutting per hill was planted at a distance of 30 cm between hills. Three nodes were buried in every replication.

Cultural management practices like weeding, rainfall as a source of irrigation, using of "tokbo" leaves to control rat infestation were uniformly employed. There were no use of synthetic fertilizers and pesticides. The four sweetpotato varieties used were taken in Cambaly, Bagulin, La Union and the different parts of the vine as planting materials served as factor A (Figure 2).

Treatment

Factor A: Vine Parts (30cm)

VP_1	Apical portion
VP_2	Middle portion
VP_3	Basal portion

Factor B: Sweetpotato Varieties

Code	Varieties
SP_1	Violet
SP_2	Candon

Figure 1. Overview of the experimental area

Figure 2. The four varieties of sweetpotato

Code	Varieties
SP_3	In-metlog
SP_4	Morado

Data Gathered

1. Meteorological data. The temperature and relative humidity were taken using a hygrometer. Rainfall was taken by placing plastic containers within the field to collect water when the precipitation occurred. The volume of water collected was measured using graduated cylinder. Rainfall was recorded by getting the average volume of water from the plastic container. Light intensity was taken using a light meter.

2. Plant survival (%). The number of plants that survived were counted one month after planting. Percent survival was computed as follows :

$$\text{Percent Survival} = \frac{\text{No of Plants Survival}}{\text{Total No. of Planted}} \times 100$$

3. Plant vigor. This was taken at 45, 75, 90 and 120 days after planting (DAP) using a rating scale (Rasco, 1996):

Scale	Description	Remarks
5	Plant were strong with robust stems and leaves are dark green in color	Highly vigorous
4	Plant were moderately strong with robust stem and leave were light green	Vigorous
3	Better than less vigor	Moderately vigorous
2	Plant were weak with few thin stems and leaves are pale	Less vigorous
1	Plant were weak with few stems and leaves, very pale	Poor vigor

4. Insect and diseases incidence. This was assessed by the degree of insect and disease damage on the crop using the following scale:

a) Rating scale for Beetles (Rasco,1996)

Rating	Description	Remarks
1	No symptoms	Very Resistant
3	Scattered spot covering 10-20% leaf surface affected	Resistant
5	Scattered spot covering 21-30% leaf surface affected	Moderately Resistant
7	Scattered to heavy spotting Covering 31-50% of leaf surface affected	Moderately Susceptible
9	Heavy spotting covering more than 50% leaf surface defoliation occurring	Susceptible

b) Rating scale for cutworm (Rasco,1996)

Scale	Description	Remarks
1	Light infestation	Very resistant
2	Medium light infestation	Resistant
3	Medium infestation	Moderately resistant
4	Medium heavy infestation	Susceptible

c) Rating scale for scab. Leaf scab infection of ten sample plants from each variety taken at random was rated starting one month after planting up to one month before harvest using the following scale (Rasco,1996):

Scale	Description	Remarks
1	Lesion on leaves and stems coalesced, severe leaf deformation and stem twisting	Susceptible
2	Severe lesion on leaves and stem coalesced, severe leaf deformation and stem twisting	Moderately Susceptible
3	Several lesion on leaves and stems, no stem deformation	Moderately Resistant
4	Few lesions on leaves and stems no stem deformation	Resistant
5	No symptoms	Very Resistant

5. Vine length (cm). The average vine length was measured from 10 sample plants taken at random per treatment at harvest.

6. Herbage yield (kg). This was taken per treatment at harvest by weighing the vines cut on the ground level.

7. Number and weight of marketable roots (kg). All storage roots with a diameter of 3cm and above and free from defects were counted and weighed.

8. Number and weight of non-marketable roots (kg). Storage roots with defects and damaged by insects and diseases and below 3cm in diameter were counted and weighed.

9. Total yield per plot (kg). This was the total weight of marketable and non- marketable storage roots recorded at harvest.

10. Computed yield (kg/ha). This was the total weight of the root yield and computed using the formula:

$$\text{Yield/ ha} = \frac{\text{Yield per Plot}}{\text{Plot Size}} \times 10{,}000$$

Data Analysis

All the results were analyzed using the analysis of variance (ANOVA) for factorial experiment. The significance of differences among treatment means were tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Meteorological Data

Table 1 shows the temperature, relative humidity, rainfall and light intensity in the experimental area during the conduct of the study. Average temperature ranged from 29 ˚C to 31˚C. Highest temperature was observed in the months of November to December which is favorable for the growth and development of sweetpotato.

Rainfall amount, on the other hand was highest in October (524.67ml) and low during the month of November to the month of January 2012. Higher light intensity was observed in January with 1950 luces while the lowest was recorded in December 2011 with 1079 luces.

Percentage Survival

Effect of planting materials. The percentage survival of sweetpotato as affected by the planting material used is shown in Table 2. The use of the tip and middle parts of the vine had significantly the highest plant survival of 97%. The use of basal part as planting material registered the lowest survival (78%).

Table 1. Meteorological data during the conduct of the study

MONTH	AVERAGE TEMPERATURE (ºC)	RAINFALL (ml)	LIGHT INTENSITY (LUX)
September	29	330.67	1796
October	30	524.67	1804
November	31	140.67	1780
December	31	164.33	1079
January	30	148.33	1950

Table 2. Percentage survival of the sweetpotato varieties using different vine parts as planting material

TREATMENT	PERCENTAGE SURVIVAL
Planting Material	
Tip	97[a]
Middle	97[a]
Basal	78[b]
Variety	
Violet	92
Candon	91
In Metlog	90
Murado	90
A x B	ns
CV	9.26%

Means with different letters are significantly differently at 5% level by DMRT.

This result confirms with the findings of Dalang (1990) that the survival and herbage yield grown from any part of the vine is not significantly different. The percentage survival maybe affected by the weather condition during the conduct of the study.

Effect of variety. No significant difference was observed on the plant survival of the sweetpotato varieties. The percentage survival ranged from 90 to 92 %.

Interaction effect. The interaction effect between the different planting materials used and the varieties was not significant on the survival of the sweetpotato.

Plant Vigor

Effect of planting material. The different planting materials used did not significantly affect the plant vigor at 45 to 119 DAP, although increasing vigor was

Table 3. Plant vigor of the sweetpotato varieties using different vine parts as planting materials

	VIGOR			
TREATMENT	45	75	90	119
Planting Material				
Tip	1	2	3	4
Middle	1	2	3	4
Basal	1	2	3	4
Variety				
Violet	1	2	3	4
Candon	1	2	3	4
In Metlog	1	2	3	4
Murado	1	2	3	4
A x B	Ns	Ns	Ns	Ns

Legend: 1 – Poor vigor; 2 – Less vigorous; 3 – Moderately vigorous; 4 – vigorous; 5 – highly vigorous

recorded from 45-119 DAP.

Effect of variety. Regardless of the variety, increasing vigor rating was observed from 45 to 119 DAP. At 45 DAP, the plants had a poor vigor but at 119 DAP, the plants were moderately strong with robust stems and leaves were light green.

Interaction effect. No significant interaction effect was noted in the sweetpotato varieties and the different planting materials used.

Reaction to Beetles, Cutworm and Scab

Effect of planting materials. The different planting materials used did not significantly affect the pest and disease incidence of beetles, cutworm and scab in sweetpotato.

Table 4. Reaction to beetle, cutworm, and scab incidence of sweetpotato varieties using different vine parts as planting materials

TREATMENT	RATING		
	BEETLE	CUTWORM	SCAB
Planting Material			
Tip	3	3	3
Middle	3	3	3
Basal	3	3	3
Variety			
Violet	3	3	2
Candon	4	3	3
In Metlog	3	3	3
Murado	3	3	3
A x B	Ns	ns	ns

Legend: 1 – Very resistant; 2 – Resistant; 3 – Moderately resistant; 4 – Susceptible

Effect of the variety. All of the varieties of sweetpotato were moderately resistant to beetles except for Candon which is moderately susceptible. On cutworm infestation, all of the varieties were moderately resistant. Most of the varieties were also susceptible to scab while Violet was moderately susceptible.

Interaction effect. No significant variations were observed among the varieties and the different planting materials on pest and disease incidence.

Herbage Yield per Plot and Vine Length

Effect of planting material. There was a significant difference observed on the herbage yield and vine length of the sweetpotato using the different planting materials. The highest herbage yield and vine length were obtained using the middle vine with 8.18

Table 5. Herbage yield and vine length of the sweetpotato varieties using different vine parts as planting materials

TREATMENT	HERBAGE YIELD ($kg/5m^2$)	VINE LENGTH (cm)
Planting Material		
Tip	5.61^{b}	168.17^{c}
Middle	8.175^{a}	226.55^{a}
Basal	5.39^{b}	201.61^{b}
Variety		
Violet	4.97^{b}	135.91^{c}
Candon	7.11^{a}	202.79^{b}
In Metlog	6.57^{a}	240.54^{a}
Murado	6.90^{a}	215.87^{ab}
A x B	*	**
CV	23.08%	13.11%

Means with different letters are significantly differently at 5% level by DMRT.

kg. The lowest herbage yield and shortest vines were obtained from the plants using the tip part with 168.17 cm.

<u>Effect of variety</u>. A significant difference was observed on the herbage yield and vine length of the sweetpotato varieties. Varieties Candon, In-metlog and Murado produced the heaviest herbage yield with 7.11 kg, 6.57 kg and 6.90 kg, respectively while Violet produced the lowest herbage yield (4.97 kg). For the vine length, the highest vine length was recorded in In-metlog with 240.54 cm comparable with Murado (215.87cm) and the shortest vine was obtained from Violet with 135.91 cm. The significant differences could be attributed to their growth habit and varietal characteristics.

Interaction effect. There was a significant interaction effect observed on the herbage yield and vine length of sweetpotato as affected by the different vine parts as planting materials and varieties. The heaviest herbage yield was noted in In-metlog using the basal part of the vine as planting material while the longest vine was obtained in In-metlog using the middle part of the vine as shown in Figures 3 and 4.

Number and Weight of Marketable Roots

Effect of planting material. Table 6 shows the response of sweetpotato on the number and weight of marketable tubers as affected by the different planting materials used. There was no significant difference observed on the use of planting material. The number and weight of marketable roots recorded a yield of 8.93 to 11.08 and 1.09 to 1.29 kg per $5m^2$, respectively. The low number of marketable roots produced depends upon many factors such as variety and environment.

Effect of variety. On the number and weight of marketable roots of sweetpotato, Violet significantly gave the highest number and weight of marketable roots but comparable to the two varieties except for Murado (Figure 5). Heaviest yield was recorded in Candon with 1.78 kg per $5m^2$. The lowest yield was recorded in Murado with 5.56 kg and number of marketable roots and 0.7 kg weight of marketable roots. The low yield was attributed to the rat infestation.

Interaction effect. The interaction effect between planting materials used and the different sweetpotato variety was not significant on the number and weight of marketable roots of sweetpotato.

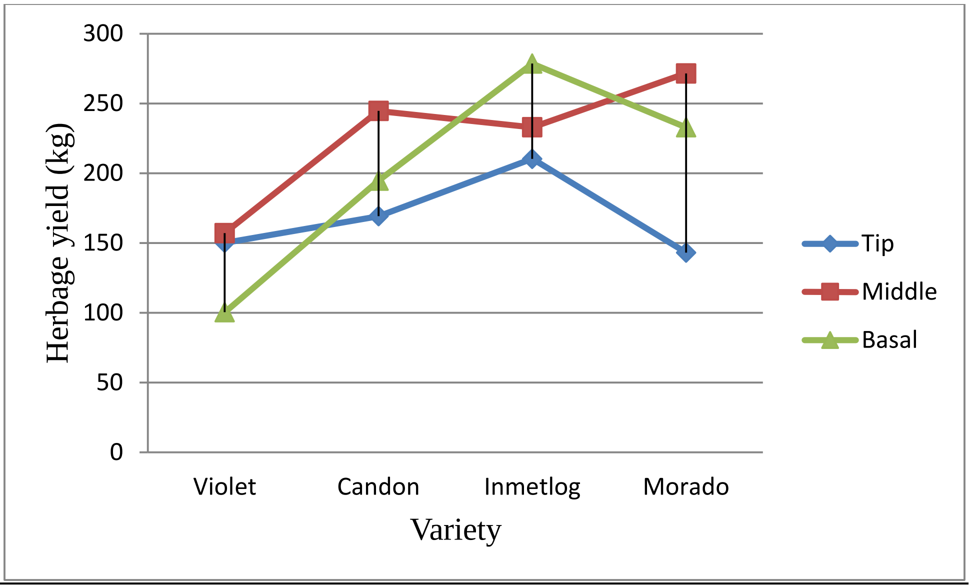

Figure 3. Interaction effect of sweetpotato varieties using different vine parts as planting materials on herbage yield

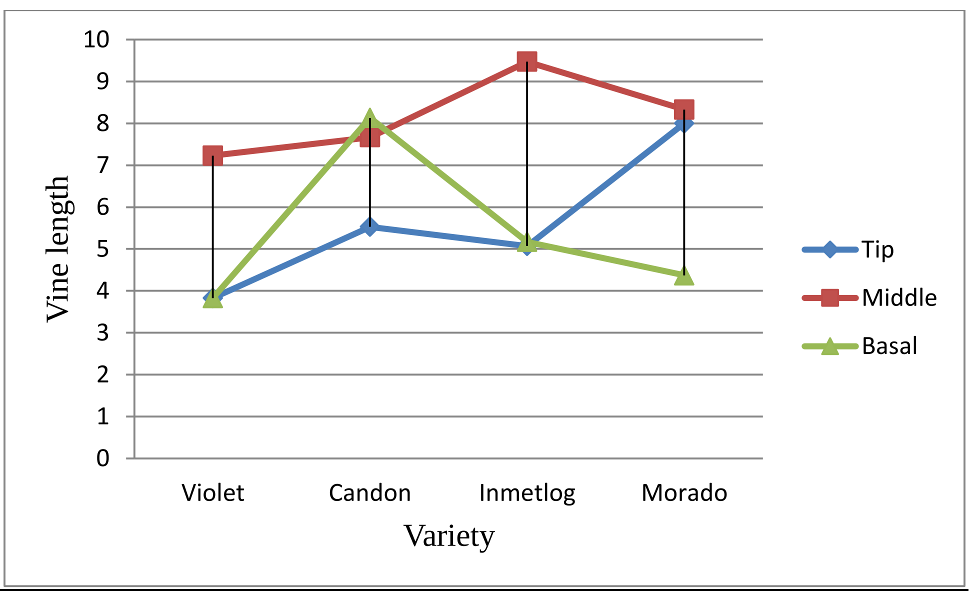

Figure 4. Interaction effect of sweetpotato varieties using different vine parts as planting materials on vine length

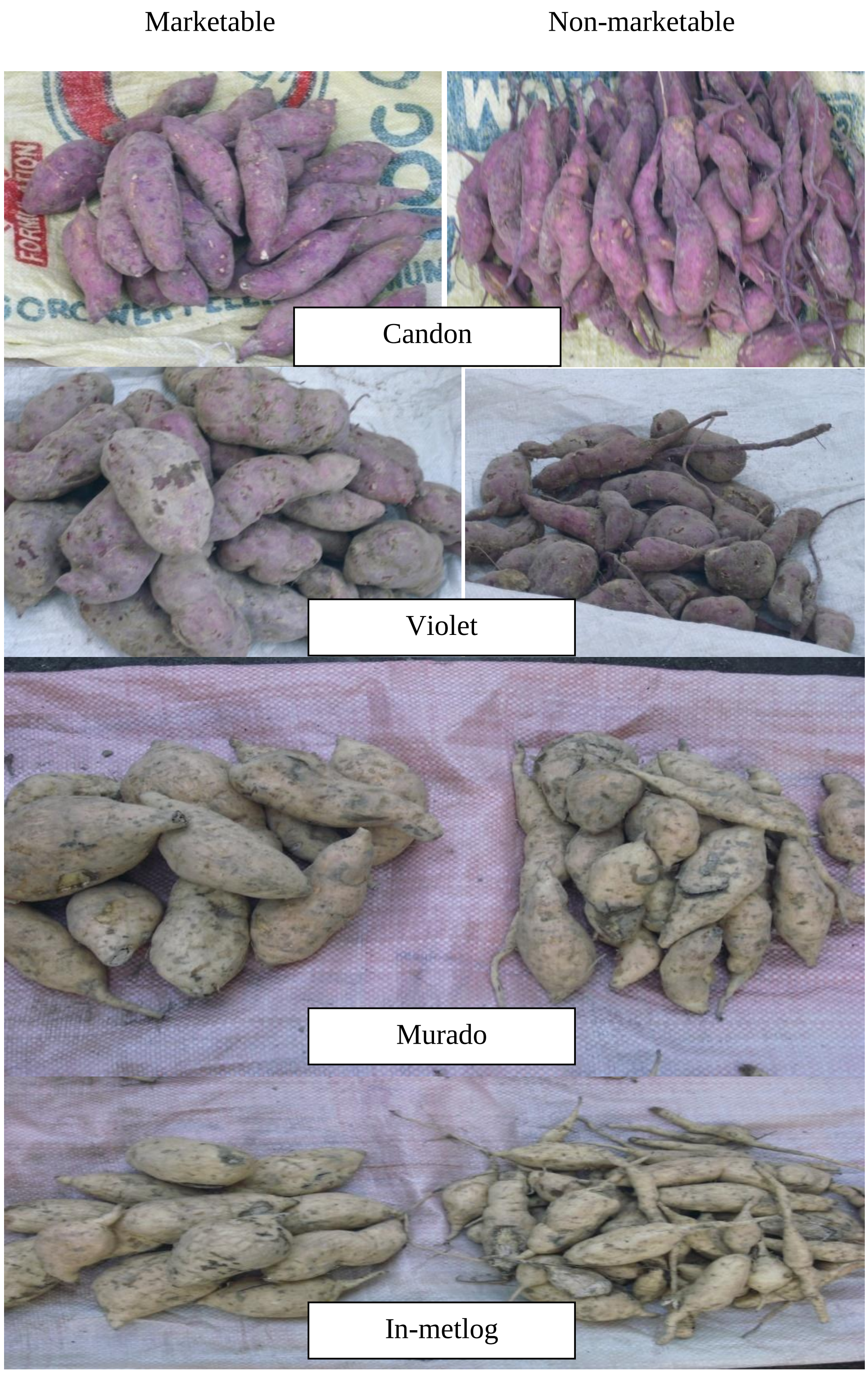

Figure 5. Marketable and non-marketable roots of the sweetpotato varieties

Table 6. Number and weight of marketable roots of sweetpotato using different vine parts as planting materials

TREATMENT	MARKETABLE ROOT	
	NUMBER	WEIGHT ($kg/5m^2$)
Planting Material		
Tip	8.93	1.29
Middle	11.08	1.11
Basal	10.08	1.09
Variety		
Violet	10.78[ab]	1.78[a]
Candon	13.67[a]	1.19[a]
In Metlog	10.10[ab]	1.0[bc]
Murado	5.56[b]	0.7[c]
A x B	ns	
CV	20.48%	23.36%

Means with different letters are significantly differently at 5% level by DMRT.

Number and Weight of Non-Marketable Roots

Effect of planting material. There was no significant difference observed on the use of different planting materials on the number and weight of non-marketable roots of sweetpotato. The number of non-marketable roots recorded ranged from 8.25 to 8.67 and the weight of non-marketable roots ranged from 0.29 to 0.34 kg per 5 m^2.

Effect of variety. On the different sweetpotato varieties, a significant difference was observed on the number and weight of non-marketable roots. The lowest number of non-marketable roots was recorded in most of the varieties except Violet with the highest number (17.67) and also registered the highest weight of non-marketable roots.

Table 7. Number and weight of non-marketable roots of sweetpotato using different vine parts as planting materials

TREATMENT	NON- MARKETABLE ROOTS	
	NUMBER	WEIGHT (kg/5m²)
Planting Material		
Tip	8.67	0.34
Middle	8.33	0.29
Basal	8.25	0.29
Variety		
Violet	17.67[b]	0.59[b]
Candon	6.89[a]	0.26[ab]
In Metlog	5.89[a]	0.29[ab]
Murado	4.56[a]	0.18[a]
A x B	ns	Ns
CV	28.08%	11.37%

Means with different letters are significantly differently at 5% level by DMRT.

Murado recorded the lowest weight of non-marketable roots of 0.18 kg/5m^2 but comparable with Candon and In-metlog.

Interaction effect. There was no significant interaction effect between the planting materials and the varieties of sweetpotato on the number and weight of non-marketable roots of sweetpotato.

Total and Computed Yield

Effect of planting material. Table 8 shows the total and computed yield of sweetpotato as affected by the planting materials. The use of tip as planting material significantly produced the highest total and computed yield of 1.61 kg/5m^2 and 3.25 t/ha, respectively. The low yield obtained with the use of the middle and basal part of the vine

Table 8. Total and computed yield of the sweetpotato using the different vine parts as planting materials

TREATMENT	YIELD	
	TOTAL ($kg/5m^2$)	COMPUTED (T/ha)
Planting Material		
Tip	1.61[a]	3.25[a]
Middle	1.39[b]	2.78[b]
Basal	1.35[b]	2.70[b]
Variety		
Violet	2.04[a]	4.08[a]
Candon	1.65[b]	3.29[b]
In Metlog	1.23[c]	2.50[c]
Murado	0.88[c]	1.70[a]
A x B	ns	ns
CV	15.34%	14.89%

Means with the different letter are significantly differently at 5% level DMRT.

as planting material could be attributed to the higher herbage yield obtained. This result coincides with the findings of Chapman and Cowling (1963) that excessive vine and growth results in low yield.

Effect of variety. There was a significant difference observed on the total and computed yield. Violet variety registered the highest yield of 2.04 $kg/5m^2$ and 4.08 t/ha while the lowest yield was obtained in In-metlog and Murado of 2.50 and 1.76 t/ha, respectively. The low yield may be attributed to rat infestation since planting time in the area did not coincide with the conduct of the study.

Interaction effect. There was no significant interaction effect was observed on the yield of sweetpotato using different vine parts as planting materials and different varieties.

Return on Cash Expense

Effect of planting material. The tip vine used as planting materials registered the highest ROCE of 42.83% while the basal portion had the lowest ROCE (17.42%) as shown in Table 9.

Table 9. Return on cash expenses of four varieties of sweetpotato using different vine parts as planting materials

TREATMENT	YIELD (kg/15 m^2)	GROSS INCOME (Php)	COST OF PRODUCTION (Php)	NET INCOME (Php)	ROCE (%)
Pm_1 – Tip					
Violet	13.60	272.00	138	134.0	97.10
Candon	11.49	228.80	138	70.8	51.30
In-metlog	7.80	156.00	138	18.0	13.09
Murado	6.12	124.40	138	-13.6	9.85
Mean					42.83
Pm_2 – Middle					
Violet	12.20	249.0	138	106.0	76.81
Candon	9.00	180.0	138	42.0	30.43
In-metlog	7.60	152.0	138	14.0	10.14
Murado	4.96	91.2	138	-46.8	-33.91
Mean					20.87
Pm_3 – Basal					
Violet	10.91	218.2	138	80.2	58.11
Candon	9.20	189.0	138	96.0	33.33
In-metlog	7.10	142.0	138	4.0	2.89
Murado	5.20	109.0	138	-34.0	-24.63
Mean					17.42

Selling price: PhP30.00/kg
Expenses: Planting material at Php5/variety and labor

Effect of sweetpotato variety. As shown in Table 9, Violet realized the highest return on cash expense of 58.11 to 97.10% while Murado had negative return on cash expense. The high ROCE recorded in Violet was due to high yield obtained.

Interaction effect. Table 9 shows that the use of the tip part as planting material using the Violet varieties of sweetpotato is more profitable with 97.10%. The lowest ROCE was obtained in Murado using the middle part as planting material.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at Cambaly, Bagulin, La Union to determine the growth and yield of the different sweetpotato varieties in Bagulin, La Union; determine the growth and yield of sweetpotato varieties using the different vine parts as planting materials; determine the best vine parts as planting materials for sweetpotato varieties; and determine the profitability of sweetpotato using the different vine parts.

Based on the results of the study, the tip vine part used as planting material had the highest percent survival, total and computed yield and the highest ROCE. Using the middle vine part produced the heaviest herbage yield and the longest vine and a comparable plant survival.

Among the sweetpotato varieties used, Violet had the heaviest total and computed yield. Comparable number and weight of marketable roots were observed in Candon, Violet, In-metlogy, and Murado. Highest herbage yield and longest vines were obtained in Violet, In-metlog and Murado.

Significant interaction effect was noted in In-metlog using the basal vine part on the production of the highest herbage yield while longest vines were obtained using the middle vine part.

Generally, the different sweetpotato plants were moderately resistant to beetles and cutworm infestation and scab infection.

Variety Violet using the tip vine part as planting material is more profitable for sweetpotato production in Bagulin, La Union. Murado using the basal vine part produced the lowest yield and ROCE.

Conclusion

The use of sweetpotato tips as planting material had the highest survival, total and computed yield. The middle part of the vine as planting material produced the highest herbage yield and longest vines.

Among the varieties, Candon produced the highest number of marketable roots and Violet had the highest total and computed yield.

Heaviest herbage and longest vines were produced from In-metlog using the basal part of the vine as planting materials while In-metlog using the vine parts had the longest vines.

Recommendation

The use of the tip part of the sweetpotato vine is still recommended as planting material. Although, the middle of the vine parts can also be used when planting material is limited. Violet variety is recommended for high yield and profit. For herbage production, the basal part of the vine of In-metlog variety as planting material is recommended.

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