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ABSTRACT

Seven sweetpotato varieties namely *Comiles*, *Bengueta*, *Haponita*, *Tres Flores*, *Kalbo-oy*, *Kuneing* and *PSBSP 17* were evaluated for leaf tips production.

All of the varieties evaluated showed no significant differences in terms of percentage survival. *Haponita* and *Kalbo-oy* were observed to be the most vigorous among the varieties evaluated. Varieties *Comiles*, *Haponita* and *Kuneing* were observed to be moderately resistant to leaf scab infection. *Comiles*, *Haponita*, *Tres Flores* and *PSBSP 17* were moderately resistant to cutworm infestation.

In terms of number of leaf tips, *Kalbo-oy* had the most number of leaf tips produced. *Kalbo-oy* was the most preferred among the varieties for general and market acceptability.

In terms of profitability *Kalbo-oy* gave the highest return on cash expense (ROCE).

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INTRODUCTION

Sweetpotato is a major subsistence crop in the Philippines. It is locally known as "*camote*" and traditionally used as staple food by many mountain tribes especially in areas where rice supply is low or not available. Every part of the sweetpotato is consumed. The storage roots are eaten as food. The tender tops are eaten as vegetable while mature vines are used as planting materials or animal feeds. It is considered as "survival crop" restored by many Filipinos during calamities and food shortage. The herbage are used as feeds for live stocks (NPRCRTC, 1990).

Sweetpotato is being grown for its storage roots and its tops or leaves that are also nutritious. As human food the tender stems and leaves are used regularly as vegetables. The leaves or the tops are excellent source of Vitamins A, B and C which may give a fuel value of 1230 calories. The tops or leaves are excellent source of pro-vitamins A and there by contributes in the prevention of Vitamin A deficiency (Yap, 1982).

It is also rich in carbohydrates and therefore contributes in the prevention of vitamin deficiency. The tops can also address the problem of food nutrient deficiency among people. The tops of sweetpotato can also be used as medicine like for example the juice of purple leaves can be a remedy for diabetes and roasted roots for diarrhea (Yap, 1982).

Sweetpotato leaf tips were used for many years as vegetables in rural and urban areas. Planting these varieties could increase production if leaf tips as vegetables even in a limited area. If these leaf tips will be brought to the market, it would mean an additional increase for the growers. These leaf tips provide nutritious food for the household.

A primary importance of sweetpotato is through consumption, utilization and nutrition. A salient question through Asia centers on why per capita sweetpotato consumption is declining. Among people, the major nutritional problems could be partially alleviated, through sweetpotato consumption. The major food problems center in protein energy malnutrition, iron deficiency anemia, vitamin A deficiency and goiter or iodine deficiency. Nutritional studies indicate that sweetpotato is a source to fight these nutritional problems. So 100 g of sweetpotato tops (leaves) meets the daily requirements for vitamin A and about one-third of daily iron requirements. There is a great potential of sweetpotato farming in contributing food requirement of the people because it is nutritious, palatable, easy to grown and has the ability to supply leaf tips for vegetables within three weeks after planting (Trougn *et al*., 1988).

The economic potential of sweetpotato farming is now widely recognized not only its storage roots but also for leaf tips which is also important in human diet. At present, our farmers still adhere to subsistence agronomic practices. Therefore, the present production of sweetpotato is very low. They should be made to explore cultural techniques to increase production through the use of organic fertilizer. It is believed that using the right kind and amount of organic fertilizer will increase the yield. Growing sweetpotato organically might not be profitable but contribute to enhancing the quality and conserving resources in the environment. Selection of suitable sweetpotato varieties for organic production must be done. The importance of sweetpotato production is viewed from the fact that it provides livelihood opportunities for 3-4 million people.

The objectives of the study were to determine the performance of sweetpotato varieties for leaf tip production and to identify the best sweetpotato variety for leaf tip production grown under organic system.

The study was conducted at Benguet State University experimental area at Balili, La Trinidad, Benguet from October 2007 to March 2008.

REVIEW OF LITERATURE

Varietal Evaluation

Varietal evaluation is a process on crop breeding program which provides comparison of promising lines with the local check in order to establish the superiority of the lines developed by a breeder. It is only through varietal evaluation that developed lines in terms of yield, quality, adaptation, stress, insect pest and diseases (Rasco and Amante, 1994).

Evaluation is the first stage of a systemic variety evaluation process. It refers to the assessment of the sustainability of potential cultivars to a given farming environment. The work is normally done by a breeder who aims to determine if a new variety is better than the local variety (Vergara, 1992).

Importance of Variety Evaluation in Organic Farming

Bautista and Mabesa (1997) cited that selecting the right variety would minimize problem associated with water and fertilizer management. Varieties should be high yielding, pest and disease resistant and early maturing so that production would entail less expense and ensure more profit. HARRDEC (1996) stated that variety evaluation is important in order to observe performance character such as yield, earliness, vigor maturity and keeping quality.

Nutritional Content of Sweetpotato Tops

Yudelman (1985) revealed that this crop can be a good source of Vitamin A, C, and iron (from the leaves) apart carbohydrates (from the roots). Consumption of sweetpotato roots and of tops averages 0.80 kg and 410 g per week, respectively. The

sweetpotato tops is good substitute for leafy vegetables which are good source of vitamins and minerals.

Importance of Sweetpotato Tops

Most Filipino families particularly those leaving in the rural areas maintain a garden where they get most of their vegetable needs. Sweetpotato is probably the only vegetable that can be eaten by humans and animals. It is nutritious so man who eats 100 grams of tops a day gets his Vitamin A for about two days, one-quarter of his Vitamin B_2 requirement, more than half of his Vitamin C and iron needs and some quantities of calcium, ash and fiber.

Sweetpotato top production is ideal for undertaking in the urban or per urban areas. It is often undertaken in a relatively large scale, say one hectare or bigger so that it could really be profitable (AVRDC, 2007).

A survey made in Tacloban, Philippines showed that vegetable consumed 75 % choose sweetpotato tops as the number one preferred vegetable primarily because it is affordable and nutritious, 65 % of consumed sweetpotato tops two to five times a week (Villamor, 1991).

Shading and fertilization significant affect shoot tip production but not the pruning frequency. In general, more shoot tips produced with 50 % shading (Villamor, 1991).

According to (Villamor *et al.*, 1979) for a particular characteristics, they could not give a specific reason and said that actually any variety would do whether green or red, degitate or heart-shaped. In terms of special desired characteristics method tenderness as a preferred quality. He stated that acceptability of sweet potato tops should be tender,

glabrous (not hairy) and purplish. However direct observation of *camote* tops in the Tacloban market shows, that there are more purple than green varieties being sold.

Sweetpotato tips are also used for food. Cultivars that yield good tips are limited and produce tips which have green and tender leaves. The tops or leaves are an excellent source of nutrient as well as the tubers (AVRDC, 2007).

Wolfe (1992) stated that home gardens selection criteria in sweet potato are the cultivar's herbage yield. Most farmers' preference are the entries purposely because of food consumption, livestock and young leaves as vegetables.

Importance of Chicken Manure

Sung-ag (1997) found that plants fertilized with chicken manure significantly increased the number of productive tillers, length of panicles, plant height at maturity and harvest index. He furthers that chicken manure seems to be the best among the organic materials as source of organic fertilizer to effect increase in yield of high yielding varieties of rice (HYV).

Daoines (1994) found that in applying organic matter like chicken manure improve soil structure. This may due to the presence of nutrient in the organic matter. He also mentioned that C:N ratio might indicate the availability of N in organic matter since the lower the C:N the better is the availability of nitrogen.

Watts (1972) stated that chicken manure is the most valuable for garden purposes. It contains a large percentage of phosphoric acid and it is especially rich in nitrogen. It has been regarded as the best fertilizer as for other garden crops requiring a large amount of nitrogen.

What is Organic Farming?

Organic farming system avoids the use of the synthetic fertilizers, pesticides and growth regulators. Instead they rely on crop rotations, crop residues, animal manures, off farm wastes, mechanical cultivation, mineral bearing rocks and biological pest control to maintain soil health, supply plant nutrients and minimize insects, weed and other pest (Sullivan, 2003).

Organic farming as a modem, sustainable fanning system which maintains the long-term fertility of soil and use less of the Earth's finite resources to produce high quality and nutritious food. It advocates the critical connections between health of the soil, health of people and health of society (Kristiansen *et al*., 2006).

Use of Organic Fertilizers

Several studies revealed that application of organic fertilizer in proper amounts can help meet the nutritional level requirement of the plant. Aside from that, it also increases the plant nutrients and improves the physical condition of the soil. Continuous use of organic fertilizer does not make the soil acidic as does the constant use of inorganic fertilizer (Kinoshita, 1977).

Manure is an effective source of nutrients for most crops. However those crops with relatively high nitrogen requirements such as corn, sorghum, and vegetables are most likely to respond to its application. Application animal manure is very important because they contain nutrients (Brady, 1985).

MATERIALS AND METHODS

Land Preparation and Experimental Design

The materials used were sweetpotato stem cuttings from different varieties, chicken manure was applied or incorporated to the soil.

An area of 105 sq. m was thoroughly prepared and divided into 3 blocks. Each block was composed of seven plots each measuring 1 m x 5 m which accommodated the different sweetpotato varieties. The organic fertilizer was applied two weeks before planting.

Before and after planting, soil samples from the experimental area were collected for chemical analysis to determine the initial fertility such as OM, pH, N, P and K content.

The experiment was laid out using the randomized completely block design (RCBD) replicated three times.

Planting Materials

Sweetpotato stem cuttings from different varieties was taken from the Northern Philippines Root Crops Research and Training Center (NPRCRTC), BSU La Trinidad, Benguet. The varieties taken were: Comiles, *Bengueta, Haponita, Tres Flores, Kalbo-oy* and *PSBSP 17*. The *Kuneing* variety was taken at Tinongdan, Itogon, Benguet. Sweetpotato stem cutting were secured from the matured plants measuring 35 cm.

Planting Distance

Sweetpotato cuttings with full length of 35 cm were planted in slanting position. Cuttings were planted in double rows at one cutting per hill with a distance of 40 cm between hills and 40 cm between rows.

Cultural Management

All the necessary cultural practices, such as proper irrigation, weeding practices and pest control were done to maintain the growth and yield of sweetpotato. Weeding and cultivation were done before the vines become too long and before they cover the space between the rows. Regular weeding was done and the crops were irrigated as necessary.

Topping Frequency

Topping was done in one month after planting then continued monthly. One foot long or 30 cm long was gathered every topping.

Data Gathered

A. Growth Performance

1. Percentage survival (%). The number of plants that survived were counted at 30 days after planting. Percent survival was computed using the following formula:

$$\% \text{ survival} = \frac{\text{number of plants survived}}{\text{total number of plants planted}} \times 100$$

2. Plant vigor. The plants were rated according to the following scale. This was recorded at 80 days after planting. The CIP rating scale, as cited by Gonzales *et al.* (2004), was used:

SCALE	DESCRIPTION	REMARKS
1	Plants are weak with few stems and leaves; very pale	Poor vigor
2	Plants are weak with few thin stems and leaves; pale	Less vigorous
3	Better than less vigorous	Moderately vigorous
4	Plants are moderately strong with robust stems and leaves; leaves are light green in color	Vigorous
5	Plants are strong with robust stems and leaves; leaves are light to dark green in color	Highly vigorous

3. Top yield (kg). This was taken monthly harvest of the sweetpotato leaf tips from the ten sample plants from each treatment per replication were cut and weighed.

4. Pest and disease rating. Common pest and disease of sweetpotato was rated using the one to five scales in increasing order of severity.

a. Rating scale for insect damage (cutworm) (Rasco, 1996).

SCALE	DESCRIPTION	REACTION
1	Light infestation	Very resistant
2	Medium light infestation	Resistant
3	Medium infestation	Moderately resistant
4	Medium heavy infestation	Moderately susceptible
5	Heavy infestation	Susceptible

b. Rating scale for disease (scab). Leaf scab infestation of the ten sample plants from each. Variety was rated one month after planting up to one month before harvesting using the following scale (Rasco, 1996).

SCALE	DESCRIPTION	REACTION
5	Lesions on leaves and stem coalesced. Severe leaf deformation and stem twisting	Susceptible
4	Several lesions on leaves and stems, lesions coalesced with slight stem deformation	Moderately susceptible
3	Several lesions on leaves and stems no stem deformation	Moderately resistant
2	Few lesions on leaves and stems; no stem deformation	Resistant
1	No symptom	Highly/ Very resistant

c. Stem scab

SCALE	DESCRIPTION	REACTION
1	No symptom	Highly resistant
2	1-25 % infection	Resistant
3	25-50 % infection	Susceptible
4	50-75 % infection	Moderately susceptible
5	75-100 % infection	Highly susceptible

B. Yield and Yield Components

1. Number and weight of leaf tips (kg). These were obtained by counting and weighting the tops gathered from each variety per replication.

C. Cost and Return Analysis

The production cost was properly recorded. This includes the gross sales, net return, (material inputs, labors and marketing). The return on cash expense (ROCE) was computed using the following formula.

$$ROCE = \frac{\text{Gross sales} - \text{Total expenses}}{\text{Total expenses}} \times 100$$

D. Sensory Evaluation

After getting all the data from the leaf tips gathered from the first topping, the tops were cooked by means of boiling in the same amount of water. The boiling of sweetpotato tops of each variety were boiled at 10 to 15 minutes at the same time. At least twenty of the students from the BSU ladies dormitory were the panelist. The sweetpotato tops were evaluated according to its appearance, color, texture, flavor and general acceptability from each variety. The following were rated using the 1-5 scale (Gonzales and Dati, 1994).

SCALE	DESCRIPTION
1	Dislike very much
2	Neither like nor dislike
3	Like slightly
4	Like moderately
5	Like extremely

E. Market Acceptability

Consumer's perception on the different tips was recorded. The characteristics of the varieties selected were noted and buyers were asked the reason for selecting a certained variety (Soliba *et al.*, 2004). Comments of the buyers was recorded or documented and they are free to select the variety of their choice.

F. Chemical Properties of the Soil

The pH, organic matter, nitrogen, phosphorous and potassium of the soil were gathered before planting and after harvesting through soil analysis at the Bureau of Soil; Aguila Road, San Fernando City, La Union.

G. Data Analysis

Data was statistically analyzed using analysis of variance for randomized completely block design. Significance of difference between treatments were tested using the Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Plant Survival

Percent survival of the seven sweetpotato varieties evaluated is presented in Table 1. 100 % survival was recorded from varieties; *Comiles*, *Bengueta*, *Haponita*, *Kuneing* and *PSBSP 17*. Variety *Kalbo-oy* and *Tres Flores* had 99 % plant survival.

Plant Vigor

Plant vigor of seven sweetpotato varieties evaluated ranged from moderately vigorous to highly vigorous. Variety *Haponita* and *Kalbo-oy* were rated highly vigorous with *Tres Flores* as moderately vigorous. Majority of the varieties had a vigorous plant growth performance.

Table 1. Percentage survival (30 DAP) and plant vigor (80 DAP) of seven varieties of sweetpotato

VARIETY	SURVIVAL (%)	PLANT VIGOR*
Comiles	100	4
Bengueta	100	4
Haponita	100	5
Tres Flores	99	3
Kalbo-oy	99	5
Kuneing	100	4
PSBSP 17	100	4
CV (%)	0 .97	

*Rating scale (1-5): 1– Poor vigor, 2 – Less vigorous, 3 – Moderately vigorous, 4 – Vigorous, 5 – Highly vigorous

Reaction to Cutworm Infestation

The Table 2 shows the cutworm infestation rating from 3.0 to 4.0. *Bengueta, Kuneing* and *Kalbo-oy* were moderately susceptible to cutworm infestation. Varieties *Comiles, Haponita, Tres Flores* and *PSBSP 17* were rated moderately resistant.

Reaction to Leaf Scab Infection

Table 2 shows the leaf scab infection ranging from 3.0 to 4.0. It was observed that both *Comiles* and *Haponita* were moderately resistant to leaf scab infection while varieties *Bengueta, Tres Flores, Kuneing* and *PSBSP 17* were moderately susceptible to leaf scab occurrence.

Reaction to Stem Scab Infection

Table 2 shows that varieties *Comiles* and *Haponita* were observed to be resistant to stem scab. Moderately resistant reaction were observed among *Bengueta, Tres Flores, Kalbo-oy, Kuneing* and *PSBSP 17*.

Table 2. Reaction of seven varieties of sweetpotato to cutworm infestation, leaf scab infection and stem scab infection

VARIETY	CUTWORM INFESTATION	LEAF SCAB INFECTION	STEM SCAB INFECTION
Comiles	3.0	3.0	2.0
Bengueta	4.0	4.0	3.0
Haponita	3.0	3.0	2.0
Tres Flores	3.0	4.0	3.0
Kalbo-oy	4.0	4.0	3.0
Kuneing	4.0	4.0	3.0
PSBSP 17	3.0	4.0	3.0

*1 – Very resistant, 2 – Resistant, 3 – Moderately resistant, 4 – Moderately susceptible, 5 – Susceptible

Average Number and Weight of
Leaf Tips of Sweetpotato

Table 3 shows the average total number and weight of leaf tips produced from the three times harvest. *Kalbo-oy* produced the most numerous leaf tips and based on the statistical analysis it obtained the highest mean of 85 which is highly significant among the other varieties evaluated. On the other hand, *Haponita* obtained the lowest number of leaf tips (25) but comparable to *Tres Flores*. In terms of weight, *Kalbo-oy* produced the highest mean of 0.72 kg respectively. The lowest weight of leaf tips was obtained by *Tres Flores* variety but comparable to *Haponita*. Such highly significant differences among the varieties could be attributed to their varietal characteristics and environmental conditions.

Table 3. Number and weight of leaf tips of seven varieties of sweetpotato

VARIETY	NUMBER*	WEIGHT (kg)
Comiles	49^{bc}	0.64^{ab}
Bengueta	45^{c}	0.54^{b}
Haponita	25^{d}	0.36^{c}
Tres Flores	33^{d}	0.35^{c}
Kalbo-oy	85^{a}	0.72^{a}
Kuneing	61^{b}	0.66^{ab}
PSBSP 17	53^{bc}	0.60^{ab}
CV (%)	13.56	13.84

*Means with the same letter are not significantly different at 5 % DMRT

Sensory Evaluation/ Acceptability of Leaf Tips

Table 4 shows that varieties *Kalbo-oy* and *Kuneing* were both rated as like extremely in terms of sensory acceptability. Varieties *Comiles, Tres Flores, PSBSP 17* and *Haponita* were rated like moderately, rated as like slightly. This shows that the six varieties were all acceptable in terms of sensory acceptability due to their green and tender young leaves. The higher the acceptability, the better is the eating quality as vegetables.

Market Acceptability of Leaf Tips

Table 5 shows the market acceptability of leaf tips from the varieties evaluated. The results follow that of the sensory evaluation variety *Kalbo-oy* and *Kuneing* were rated as liked extremely by the buyers (panelist).

Table 4. Sensory evaluation of leaf tips of seven varieties of sweetpotato

VARIETY	APPEARANCE	COLOR	FLAVOR	TEXTURE	GENERAL ACCEPTABILITY
Comiles	Like moderately	Like moderately	Like moderately	Like moderately	Like moderately
Bengueta	Like slightly	Like slightly	Like slightly	Like slightly	Like slightly
Haponita	Like moderately	Like moderately	Like moderately	Like slightly	Like moderately
Tres Flores	Like moderately	Like moderately	Like moderately	Like moderately	Like moderately
Kalbo-oy	Like moderately	Like moderately	Like extremely	Like slightly	Like extremely
Kuneing	Like moderately	Like moderately	Like moderately	Like moderately	Like extremely
PSBSP 17	Like moderately	Like moderately	Like moderately	Like slightly	Like moderately

Table 5. Market acceptability of leaf tips of seven varieties of sweetpotato

VARIETY	TENDERNESS	COLOR	TEXTURE	APPEARANCE	GENERAL ACCEPTABILITY
Comiles	Like moderately	Like moderately	Like moderately	Like moderately	Like moderately
Bengueta	Like slightly	Like slightly	Like slightly	Like slightly	Like slightly
Haponita	Neither like nor dislike	Like slightly	Like slightly	Like moderately	Like moderately
Tres Flores	Like slightly	Like moderately	Like moderately	Like moderately	Like moderately
Kalbo-oy	Like extremely	Like extremely	Like extremely	Like moderately	Like extremely
Kuneing	Like extremely	Like moderately	Like moderately	Like moderately	Like extremely
PSBSP 17	Like moderately	Like moderately	Like slightly	Like moderately	Like moderately

Cost and Return Analysis

Table 6 shows the return on cash expense (ROCE) of sweetpotato leaf tips production. The results showed that *Kalbo-oy* variety had the highest return on cash expense on leaf tips produced. The other varieties evaluated showed a negative (ROCE) due to low yield of the varieties evaluated.

Soil Chemical Properties

The initial and final analysis of the soil taken from the experimental area are shown in Table 7.

The initial pH of the soil was 6.3 with organic matter content of 2.5 %. The nitrogen, phosphorous and potassium content of the soil are 0.12 %, 100 ppm and 340 ppm, respectively.

Table 6. Cost and return analysis based on leaf tip yield

TREATMENT	VARIABLE COST		YIELD TIPS (kg)	GROSS SALES (PhP)	TOTAL EXPENSES (PhP)	NET INCOME	ROCE
	LABOR COST	FERTILIZER COST					
Comiles	161	71	1.95	234.00	246.00	-12.00	-4.87
Bengueta	161	71	1.65	173.25	246.00	-72.75	-29.57
Haponita	161	71	1.25	93.75	246.00	-152.25	-61.89
Tres Flores	161	71	1.21	90.00	246.00	-156.00	-63.89
Kalbo-oy	161	71	2.96	534.60	246.00	288.60	117.31
Kuneing	161	71	1.97	236.40	246.00	-9.60	-3.90
PSBSP 17	161	71	1.85	194.25	246.00	-51.75	-21.04

- The variable cost includes = (labor and fertilizer cost)
- Based at 15.00 /bundle = (per bundle composed of 250 g)
- Chicken manure = PhP 100.00 / sacks

The soil applied with chicken manure had an increased soil pH. This confirms the findings of Watts (1972) that application of chicken manure would increased the pH level of the soil, organic matter content of the soil and this could be due to the addition of organic materials. The phosphorous content of the soil had increased from 100 ppm to 160 ppm. The potassium content of the soil had increased from 340 ppm to 422 ppm.

Table 7. Soil analysis before and after planting

	pH	OM (%)	N (%)	P (ppm)	K (ppm)
Before planting	6.3	2.5	0.12	100	340
After planting	6.4	2.5	0.14	160	422

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted to evaluate seven sweetpotato varieties for leaf tips production grown under organic system at the Balili Experimental Station, Benguet State University. The different varieties used were *Comiles, Tres Flores, Haponita, Bengueta, Kalbo-oy, Kuneing* and *PSBSP 17*. Findings revealed that the different varieties shows no significant differences in terms of percentage survival at 30 days after planting, plant vigor, cutworm infestation, leaf scab infection and stem scab infection. Numerically, however, variety *Haponita* and *Kalbo-oy* were both observed to be highly vigorous among the seven varieties evaluated.

There are no varieties found to be resistant to cutworm infestation. Varieties *Comiles, Haponita, Tres Flores, PSBSP 17* were moderately resistant and the other varieties were observed to be moderately susceptible. In terms of leaf scab infection, both *Comiles* and *Haponita* were observed to be moderately resistant while the other varieties were moderately susceptible. However, variety *Haponita* and *Comiles* are both resistant to stem scab infection.

In terms of number and weight of leaf tips, numerically, *Kalbo-oy* variety produced the most numerous number and heaviest leaf tips (0.72 kg).

As to general acceptability of leaf tips, the panelists preferred most *Kalbo-oy* and *Kuneing*. Varieties *Comiles, Haponita, Tres Flores* and *PSBSP 17* were liked moderately. Variety *Bengueta* was liked slightly.

In terms of profitability *Kalbo-oy* gave the highest ROCE of leaf tips followed by *Kuneing* and comparable to *Comiles, Tres Flores* and *PSBSP 17*.

Conclusion

Variety *Kalbo-oy* proved to be good for leaf tip production. It is most preferred in the market and is profitable to produce.

Recommendation

Under the condition of the study, variety *Kalbo-oy* is highly recommended for leaf tips production.

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APPENDICES

APPENDIX TABLE 1. Plant survival (%)

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	100	100	100	300	100
Bengueta	100	100	100	300	100
Haponita	100	100	100	300	100
Tres Flores	100	100	97	297	99
Kalbo-oy	100	97	100	297	99
Kuneing	100	100	100	300	100
PSBSP 17	100	100	100	300	100
TOTAL	700	697	697	2, 094	698

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	0.857	0.429			
Treatment	6	4.286	0.714	0.77^{ns}	3.0	4.82
Error	12	11.143	0.929			
Total	20	16.286				

^{ns}–Not significant CV (%) =0.97

APPENDIX TABLE 2. Plant vigor

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	5	4	3	12	4.00
Bengueta	4	4	4	12	4.00
Haponita	5	5	4	14	4.67
Tres Flores	3	4	3	10	3.33
Kalbo-oy	4	5	5	14	4.67
Kuneing	4	4	4	12	4.00
PSBSP 17	3	4	4	11	3.67
TOTAL	28	30	27	85	28.34

APPENDIX TABLE 3. Pest incidence (cutworm damage)

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	3	2	3	8	2.67
Bengueta	3	4	5	12	4.00
Haponita	4	3	3	10	3.33
Tres Flores	3	3	3	9	3.00
Kalbo-oy	3	5	4	12	4.00
Kuneing	3	4	4	11	3.67
PSBSP 17	4	3	3	10	3.33
TOTAL	23	24	25	76	24.00

APPENDIX TABLE 4. Leaf scab incidence

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	4	3	3	10	3.33
Bengueta	4	5	4	13	4.33
Haponita	3	4	3	10	3.33
Tres Flores	5	4	3	12	4.00
Kalbo-oy	4	4	5	13	4.33
Kuneing	4	4	3	11	3.67
PSBSP 17	3	4	5	12	4.00
TOTAL	27	28	25	81	26.99

APPENDIX TABLE 5. Stem scab incidence

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	3	2	2	7	2.33
Bengueta	2	3	3	8	2.67
Haponita	2	2	3	7	2.33
Tres Flores	3	3	3	9	3.00
Kalbo-oy	4	2	3	9	3.00
Kuneing	3	4	3	10	3.33
PSBSP 17	3	2	3	9	3.00
TOTAL	20	18	20	59	19.66

APPENDIX TABLE 6. Number of leaf tips (first harvest)

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	34	37	20	91	30 b
Bengueta	28	27	41	96	32 b
Haponita	4	11	20	35	12 cd
Tres Flores	7	20	5	32	11 d
Kalbo-oy	53	76	44	173	58 a
Kuneing	26	30	26	82	27 bc
PSBSP 17	22	25	23	70	23 bcd
TOTAL	174	226	179	579	28

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	235.143	117.571			
Treatment	6	4,469.143	744.557	10.24**	3.0	4.82
Error	12	872.857	72.738			
Total	20	5,577.143				

**–Highly significant CV (%) =30.93

APPENDIX TABLE 7. Weight (kg) of leaf tips (first harvest)

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	0.770	0.790	0.490	2.050	0.683 [ab]
Bengueta	0.452	0.470	0.740	1.662	0.554 [ab]
Haponita	0.094	0.186	0.412	0.692	0.231 [c]
Tres Flores	0.151	0.360	0.121	0.632	0.211 [c]
Kalbo-oy	0.748	0.806	0.548	2.102	0.701 [a]
Kuneing	0.345	0.566	0.520	1.431	0.477 [b]
PSBSP 17	0.475	0.584	0.540	1.599	0.533 [b]
TOTAL	3.035	3.762	3.371	10.259	0.488

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	0.030	0.019			
Treatment	6	0.699	0.116	6.13**	3.0	4.82
Error	12	0.228	0.019			
Total	20	0.964				

**–Highly significant CV (%) =28.46

APPENDIX TABLE 8. Number of leaf tips (second harvest)

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	77	79	63	219	73 [b]
Bengueta	62	64	55	181	60 [b]
Haponita	32	41	39	112	37 [c]
Tres Flores	46	58	56	160	53 [bc]
Kalbo-oy	103	146	89	338	113 [a]
Kuneing	54	62	68	184	61 [b]
PSBSP 17	66	66	77	209	70 [b]
TOTAL	440	516	447	1,403	67

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	504.095	252.048			
Treatment	6	9,815.238	1,635.673	10.24**	3.0	4.82
Error	12	1,763.905	146.992			
Total	20	12,083.238				

**–Highly significant CV (%) =18.15

APPENDIX TABLE 9. Weight (kg) of leaf tips (second harvest)

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	0.61	0.92	0.85	2.38	0.79 [abc]
Bengueta	0.57	0.52	0.64	1.73	0.58 [bcd]
Haponita	0.41	052	0.45	1.38	0.46 [d]
Tres Flores	0.51	0.58	0.56	1.65	0.55 [cd]
Kalbo-oy	0.85	1.14	0.60	2.59	0.86 [a]
Kuneing	0.52	0.64	0.95	2.11	0.70 [abcd]
PSBSP 17	0.82	0.86	0.83	2.51	0.84 [ab]
TOTAL	4.29	5.08	4.88	14.35	0.68

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	0.059	0.029			
Treatment	6	0.442	0.074	3.46**	3.0	4.82
Error	12	0.256	0.021			
Total	20	0.767				

** – Highly significant CV (%) =21.36

APPENDIX TABLE 10. Number of leaf tips (third harvest)

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	44	39	42	125	42 [cd]
Bengueta	40	47	55	142	47 [bc]
Haponita	31	23	26	80	27 [d]
Tres Flores	35	29	42	106	35 [c]
Kalbo-oy	98	72	87	257	86 [a]
Kuneing	115	89	76	280	93 [a]
PSBSP 17	63	51	82	196	65 [b]
TOTAL	426	350	410	1,186	56

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	450.667	229.333			
Treatment	6	11,782.571	1,963.762	16.81**	3.0	4.82
Error	12	1,402.000	116.833			
Total	20					

**–Highly significant CV (%) =19.14

APPENDIX TABLE 11. Weight (kg) of leaf tips (third harvest)

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	0.52	0.41	038	1.31	0.44 [cd]
Bengueta	0.52	0.46	0.57	1.55	0.52 [bc]
Haponita	0.46	0.33	0.39	1.18	0.39 [c]
Tres Flores	0.30	0.21	0.41	0.92	0.31 [d]
Kalbo-oy	0.68	0.52	0.59	1.79	0.60 [b]
Kuneing	0.89	0.76	0.68	2.33	0.78 [a]
PSBSP 17	0.38	0.32	0.60	1.30	0.43 [c]
TOTAL	3.75	3.01	3.62	10.38	0.49

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	0.045	0.022			
Treatment	6	0.429	0.072	10.78**	3.0	4.82
Error	12	0.080	0.007			
Total	20					

**–Highly significant CV (%) =16.48

APPENDIX TABLE 12. Average number of leaf tips

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	52	52	42	146	49 [bc]
Bengueta	43	46	50	139	46 [c]
Haponita	22	25	28	75	25 [d]
Tres Flores	29	36	34	99	33 [d]
Kalbo-oy	85	98	73	256	85 [a]
Kuneing	65	60	57	182	61 [b]
PSBSP 17	50	47	61	158	53 [bc]
TOTAL	346	317	345	1,055	352

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	32.667	16.333			
Treatment	6	6,894.476	1,149.079	24.77**	3.0	4.82
Error	12	556.667	43.389			
Total	20	7,483.810				

**–Highly significant CV (%) =13.56

APPENDIX TABLE 13. Average weight (kg) of leaf tips

VARIETY	REPLICATION			TOTAL	MEAN
	I	II	III		
Comiles	0.63	0.71	0.57	1.91	0.64 [ab]
Bengueta	0.51	0.48	0.65	1.64	0.55 [b]
Haponita	0.32	0.35	0.42	1.09	0.36 [c]
Tres Flores	0.32	0.38	0.36	1.06	0.35 [c]
Kalbo-oy	0.76	0.82	0.58	2.16	0.72 [a]
Kuneing	0.59	0.66	0.72	1.97	0.66 [ab]
PSBSP 17	0.56	0.59	0.66	1.81	0.60 [ab]
TOTAL	3.69	3.99	3.96	11.64	3.88

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	2	0.008	0.004			
Treatment	6	0.372	0.062	10.54**	3.0	4.82
Error	12	0.071	0.006			
Total	20	0.457				

**–Highly significant CV (%) =13.84