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ABSTRACT

The study was conducted to determine the suitability of different corn varieties as an alternate to rice and soybean coffee and to identify the corn variety with the best cup quality based on aroma, color, taste and acceptability.

Based on the results, Gasilang had the highest dry matter and sugar content. Corn coffee processed from Gasilang had strong aroma, very bitter taste, very dark brown color, and was liked very much by coffee drinkers. Lagkitan Kibungan and Sweet Corn Hybrid had relatively high sugar contents and ground kernel recovery. Corn coffee processed from Sweet Corn Hybrid was also liked very much by coffee drinkers. Corn coffee processed from Rice and Popcorn, on the other hand, were liked very much by non coffee drinkers.

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INTRODUCTION

Corn (*Zea mays)* is the second most important crop in the Philippines. It is used as a staple food especially in areas where rice is not readily available (Chapman and Carter, 1976).

Corn kernels contain vitamins A, B, C, thiamine, niacin, and important minerals like calcium and iron (Gagni and Tabinga, 1985). Thus, corn kernels are processed into various products such as corn flour, corn syrup and others. Corn kernels are also roasted and used as a coffee substitute. In fact, native Americans roast corn kernels instead of coffee beans and drink it as they would coffee (Casey, 2010).

The low caffeine content in the corn makes it an ideal substitute for coffee. Caffeine often causes restlessness, head ache, tense muscles, sleep disturbance, and irregular heartbeats. Caffeine also increases the production of stomach acid which may worsen ulcer symptoms or heartburn (Potter and Hutchkniss, 1995).

Using corn as coffee substitute is also said to be satisfying and is guaranteed to take the edge of hunger pangs between meals. The natural sugar in corn also results in a drink that makes addition of sugar unnecessary (Casey, 2010).

Furthermore, corn kernels have less oil content than soybean seeds, which may make the drink oily when prepared. Using corn as coffee is also better than using rice because rice grains contain more carbohydrates. People who are conscious of their diet prefer lesser carbohydrates (World Encyclopedia, 2005).

It is therefore necessary to study the potential of corn as a coffee substitute. A drink with low caffeine may be developed while the taste, aromatic acceptability, and quality of coffee may be preserved.

The study was conducted to determine the suitability of different corn varieties as an alternate to rice and soybean coffee and to identify the corn variety with the best cup quality based on aroma, color, taste and acceptability.

The study was conducted at Benguet State University from November to March 2010.

REVIEW OF LITERATURE

Coffee Substitutes

Co (1861) reported that experienced and devoted lovers of coffee have tried wheat and report it annually that it impacts the genuine aromatic properties of coffee. The grains are ground together, boiled and then served as coffee.

Griffteth (2002) mentioned that okra could be a good substitute for coffee. Okra seeds are parched over a good fire and stirred well until it is dark brown. The white of an egg is added to a full cup of roasted okra seeds and mixed well. The mixture is then boiled and drank like coffee.

Sweet potato can also be a good substitute for coffee. The storage roots are peeled and sliced thinly. The sliced roots are dried and then cut into small pieces enough to go into the coffee mill. The roots are ground, boiled and served as coffee (Patriot, 1864).

Furthermore, many people are daily in the habit of using rye as a substitute for coffee without being aware of the fact that the grains when burnt contains above 50% of phosphorus acid. In young people, it effectively prevents the development of osseous tissues and in old people it prevents the foundation of dry gangrene (Athens, 1865).

Processing Techniques

The most important contributor of flavor profile in the processing technique of coffee is the method of processing. Coffee can be processed in different ways but its beverage quality depends on the microclimatic type of plants. Therefore, the climate dictates the type of processing that needs to be done. Further, processing techniques help to attain the flavor that is designed by the producer and consumer (Clifford, 2007).

Effects of Coffee on Physical Health

Individuals who are sensitive to caffeine may substitute to decaffeinated coffee. While caffeine is a moderately habituating drug, coffee is not regarded as harmful to the average adult. Indeed, coffee may be beneficial. Medical authorities generally recommended that coffee should not be given to young children (Desrosier, 1977).

Some individuals can drink several cups of coffee in an hour and notice no effect while others may feel a strong effect with just one cup of coffee. Too much caffeine can cause restlessness, nausea headache, tense muscles, sleep disturbance and irregular heartbeats. Caffeine increases the production of stomach acid that may worsen ulcer symptoms or heartburn. Drinking coffee at evening may disrupt sleep and cause insomnia. Although caffeine does not fall into the class of addictive drugs, some people may experience headache, fatigue, irritability and nervousness when their daily intake of caffeine is quickly and substantially altered (Desrosier, 1977).

MATERIALS AND METHODS

An area of 150 m^2 was thoroughly prepared before planting. Ten varieties of corn gathered from different location were planted in unreplicated plots. Cultural practices in corn production such as weeding, irrigation and spraying were done uniformly to ensure good growth and yield of the crop.

After maturity the corn were harvested and sun dried. Corn kernels were removed from the cob and 100 g of kernels were weighed for each treatment. The corn kernels were roasted for 15 minutes and ground or pounded into powder. The roasted ground kernels was added to water that has been boiling for five minutes and then boiled again for another five minutes until its aroma becomes evident. After boiling, the corn drink was filtered for more translucent quality.

Twenty panelists composing of ten coffee and ten non-coffee drinkers were given one cup each for sensory evaluation.

The treatments which were replicated three times were as follows:

CODE	VARIETY	SOURCE
V_1	Sweet corn (hybrid)	La union
V_2	Glutinous white	Barlig
V_3	Popcorn	Nueva Viscaya
V_4	Sweet corn (native)	Sabangan
V_5	Gasilang	Nueva Viscaya
V_6	Lagkitan (Kibungan)	Kibungan
V_7	Sabangan corn 1	Sabangan

V_8	Sabangan corn 2	Sabangan
V_9	Sabangan corn 3	Sabangan
V_{10}	Glutinous yellow	Barlig
Check	Rice	Sabangan
Check	Soybean	Bauko

Data Gathered

1. Dry Matter Content. This was taken by oven drying 100g of corn kernels for 72 hours at 100^{o}C. This was computed using the following formula:

%Dry matter content = 100%- moisture content

Where:

$$\%\text{Moisture Content} = \frac{\text{Fresh weight- Oven dry weight}}{\text{Fresh weight}} \times 100$$

2. Sugar content. Sugar content was determined by using a digital refractometer from the extracted juice of corn kernels.

3. Characteristics of ground kernels. This was taken by evaluating the ground kernels using the following scale (Paajanen, 2007):

Scale	Description
1	Coarse
2	Medium
3	Fine
4	Extra fine
5	Turkish

4. Ground kernel recovery (%). This was taken by weighing the unground and ground kernels then computed using the formula:

$$\% \text{ recovery} = \frac{\text{Ungrounded kernels} - \text{Ground kernels}}{\text{Ungrounded kernels}} \times 100$$

5. Sensory evaluation. This was gathered using the following rating scales (Madchawing, 2005):

a. Aroma. This was gathered using the following scale:

Scale	Description	Remarks
4	Strong aroma	Having an intense degree of smell
3	Moderate aroma	Having a temperate degree of smell
2	Slight aroma	Having extremely low degree of smell
1	Poor aroma	Having a little degree or no smell

b. Taste. This was taken using the following scale:

Scale	Description
4	Extremely bitter
3	Very bitter
2	Moderate bitter
1	No bitter taste

c. Color. This was gathered using the following scale:

Scale	Description
4	very dark brown
3	dark brown
2	light brown
1	yellowish brown

d. General acceptability. This was gathered using the following scale:

Scale	Description
1	like very much
2	like moderately
3	neither liked nor disliked
4	disliked moderately
5	dislike very much

Data Analysis

All quantitative data were computed using analysis of variance for Completely Randomized Design (CRD). The significance of treatment means was computed using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Temperature, Relative Humidity, Rainfall and Sunshine Duration

The temperature, relative humidity, amount of rainfall, and sunshine duration from August to December are presented in Table 1. The temperature ranged from 14.3^{o}C to 24.3^{o}C. Relative humidity from August to December was 84.8% while amount of rainfall ranged from 12.3 to 45 mm. Rainfall amount is very low compared to the monthly requirement of corn which is 200mm for dry months and 250mm for wet months during germination and flowering (Schiller *et al*, 2006). Sunshine duration had an average mean of 372.58 min.

Corn can be grown successfully in regions that have a mean of temperature at about 21^{o}C for germination and 32^{o}C for growth (Singh, 1992).

Table 1. Temperature, relative humidity, rainfall amount and sunshine duration during the conduct of the study

MONTHS	TEMPERATURE			RELATIVE HUMIDITY (%)	RAINFALL AMOUNT (mm)	SUNSHINE DURATION (Min)
	MAX	MIN	AVERAGE			
August	19.5	14.3	16.9	77	45.0	141.3
September	___	16.1	16.1	85	12.3	793.9
October	22.3	16.0	19.2	86	21.8	329.6
November	22.6	14.6	18.6	88	16.4	229.3
December	24.3	15.5	19.9	88	19	368.8
Mean	22.2	15.3	18.8	85	22.9	372.6

Dry Matter Content

Highly significant differences are observed in the dry matter content of the different treatments (Table 2). Glutinous yellow obtained the highest dry matter content (17.1%) while rice grains obtained the lowest dry matter content (11.4%). The average dry matter content of corn is approximately 14-16% but varies widely depending on cultivars, location, climate, and day length (PCARRD, 1981).

Dry matter content of kernels might give a better insight to the alterations that occur during roasting (Tonroy and Perry, 2006) and to ground kernel recovery. Corn kernels with high dry matter might result in better roasting and higher recovery.

Sugar Content

Highly significant differences are observed in the sugar content of the different treatments (Table 2). The highest sugar content was observed from Lagkitan Kibungan (4.8 ^{o}Brix) but comparable with Glutinous Yellow, Popcorn, Sweetcorn Hybrid, Sweetcorn native and Gasilang.

Corn kernels with sugar contents of 3.5 to 6.0% is preferable since it makes the addition of sugar unnecessary (Casey, 2010).

Table 2. Dry matter and sugar content of corn varieties evaluated as rice and soybean coffee substitute

TREATMENT	DRY MATTER CONTENT (%)	SUGAR CONTENT (^{o}BRIX)
Sabangan mais 1	14.4^{c}	2.5^{cd}
Sabangan mais 2	14.8^{bc}	2.7^{c}
Glutinous white	15.0^{b}	3.7^{b}
Sabangan mais 3	15.2^{b}	1.8^{d}
Glutinous yellow	17.1^{a}	4.0^{ab}
Popcorn	12.5^{f}	4.3^{ab}
Sweet corn hybrid	14.4^{c}	4.5^{ab}
Sweet corn native	12.8^{f}	4.3^{ab}
Lagkitan Kibungan	13.4^{d}	4.8^{ab}
Gasilang	16.1^{a}	4.4^{ab}
Rice (check)	13.0^{de}	3.8^{b}
Soybean (check)	11.4^{g}	2.5^{cd}
CV (%)	1.93	12.50

For each column, means with the same letter are significantly different at 5% probability using DMRT

Percent Ground Roasted Kernel Recovery

Highly significant differences are observed on the percent ground roasted kernel recovery of the different treatments evaluated (Table 3). Rice significantly had the highest ground roasted kernel recovery followed by Lagkitan Kibungan and Sweetcorn Hybrid. The rest of the entries had a ground roasted kernel recovery ranging from 78.5 to 81.6%

High ground roasted kernel recovery may indicate that when more ground kernels recovered, more coffee will be produced thus leading to a higher income.

Table 3. Percent ground roasted kernel recovery of corn varieties evaluated as rice and soybean coffee substitute

ENTRY	GROUND KERNEL RECOVERY (%)
Sabangan mais 1	80.8[e]
Sabangan mais 2	81.0[cd]
Glutinous white	81.0[cd]
Sabangan mais 3	81.7[c]
Glutinous yellow	78.5[f]
Popcorn	78.6[f]
Sweet corn hybrid	80.5[e]
Sweet corn native	82.4[b]
Lagkitan Kibungan	82.7[b]
Gasilang	79.4[f]
Rice (check)	84.7[a]
Soybean (check)	81.6[c]
CV (%)	1.83

For each column, means with the same letter are significantly different at 5% probability using DMRT

Characteristics of Ground Kernels

The roasted ground kernels of the different corn varieties were extra fine.

Sensory Dvaluation

Aroma. Non coffee drinkers rated corn coffee processed from Gasilang as strongly aromatic while coffee drinkers rated corn coffee processed form Sweetcorn hybrid, Gasilang and Soybean as having strong aroma. The corn coffee processed from the rest of the varieties were slightly to moderately aromatic (Table 4).

Aroma is important to corn coffee since simply inhaling the aroma alters the activity of cells in the brain (Science Daily, 2008). Aroma is also responsible for all flavor attributes other than taste attributes that are perceived by the tongue. Therefore, it might be said that aroma is the most important attribute to specialty coffee (Golden Field, 2009). Slight aroma in corn coffee results to a dramatic decrease in the overall coffee flavor.

Thus, corn coffee processed from Sweetcorn Hybrid and Gasilang may have strong coffee flavor due to its strong aroma.

Taste. Results showed (Table 5) that corn coffee processed from Sabangan mais 1 and 3, Lagkitan Kibungan, and Gasilang were rated as very bitter by non coffee drinkers. In contrast, corn coffee processed from Sabangan mais 1 was rated as very bitter by coffee drinkers. Most of the corn coffee processed from the varieties were rated as moderately bitter by both non coffee and coffee drinkers.

Coffee bitterness is sometimes a negative, but omnipresent, aspect of the beverage. At low levels, bitterness helps tame coffee acidity and adds another favorable dimension to the brew. However, at high levels, a bitter coffee compound can overpower

the other components present in coffee producing an undesirable effect (Coffee Research Institute, 2006).

Table 4. Aroma of the corn coffee processed from different corn varieties

TREATMENT	AROMA RATING	
	NON COFFEE DRINKERS	COFFEE DRINKERS
Sabangan mais 1	3	3
Sabangan mais 2	3	3
Glutinous white	3	3
Sabangan mais 3	3	3
Glutinous yellow	2	3
Popcorn	3	3
Sweet corn hybrid	3	4
Sweet corn native	3	3
Lagkitan Kibungan	3	3
Gasilang	4	4
Rice (check)	2	3
Soybean (check)	3	4
CV (%)	18.25	17.33

Rating Scale: 1-poor aroma, 2-slight aroma, 3-moderate aroma, 4-strong aroma

Coffee drinkers prefer very bitter coffee thus, corn coffee processed form Sabangan mais 1, Sabangan mais 3, Lagkitan Kibungan and Gasilang having very bitter taste may be preferred over the other varieties. Moreover, these varieties had low sugar contents which may have contributed to the bitter taste of the beverage. For instance, corn coffee processed from Sabangan mais 1 and 3 which had low sugar contents (2.5 ^{o}Brix and 1.8 ^{o}Brix) also had very bitter taste.

Table 5. Taste of the corn coffee processed from different varieties

TREATMENT	TASTE RATING	
	NON COFFEE DRINKERS	COFFEE DRINKERS
Sabangan mais 1	3	3
Sabangan mais 2	2	1
Glutinous white	2	2
Sabangan mais 3	3	2
Glutinous yellow	2	2
Popcorn	2	2
Sweet corn hybrid	2	2
Sweet corn native	2	2
Lagkitan Kibungan	3	2
Gasilang	3	2
Rice (Check)	2	1
Soybean (check)	2	2
CV (%)	16.39	16.18

Rating scale: 1-no bitter taste, 2-moderately bitter, 3-very bitter, 4-extremely bitter

Color. Non coffee drinkers rated corn coffee processed form Sabangan mais 1 and 3, Lagkitan Kibungan and Gasilang as very dark brown while the corn coffee processed form the rest of the varieties were rated dark brown. For coffee drinkers, corn coffee processed from Sabangan mais 1 was rated as very dark brown while Rice and Sabangan mais 2 were rated light brown. The corn coffee processed from the rest of the varieties was rated as dark brown (Table 6).

Table 6. Color of the corn coffee processed from different varieties

TREATMENTS	COLOR RATING	
	NON COFFEE DRINKERS	COFFEE DRINKERS
Sabangan mais 1	4	4
Sabangan mais 2	3	2
Glutinous white	3	3
Sabangan mais 3	4	3
Glutinous yellow	3	3
Popcorn	3	3
Sweet corn hybrid	3	3
Sweet corn native	3	2
Lagkitan Kibungan	4	3
Gasilang	4	3
Rice (check)	3	2
Soybean (check)	3	3
CV (%)	16.38	13.97

Rating scale: 1-yelloish brown, 2-light brown, 3-dark brown, 4-very dark brown

The importance of color to corn coffee is that it increases the eagerness of the drinkers to consume the beverage. Thus, a darker color is preferred by coffee drinkers. In addition the color of the coffee may imply its taste; the darker the color the bitter its taste. Thus, corn coffee processed from Sabangan mais 1 which was very dark brown also had very bitter taste.

General Acceptability. Among the treatments, corn coffee processed from Rice and Popcorn were liked very much by non coffee drinkers. For the coffee drinkers, corn coffee processed from Soybean, Gasilang and Sweetcorn hybrid were liked very much. The corn coffee processed from the rest of the varieties was liked moderately (Table 7).

The general acceptability of corn coffee may be attributed to the aroma, color, and taste of the beverage. For instance, corn coffee processed from Gasilang which was liked very much by coffee drinkers also had strong aroma, very bitter taste, and dark to very dark brown color.

Table 7. General acceptability of corn coffee processed from different varieties

TREATMENT	GENERAL ACCEPTABILITY RATING	
	NON COFFEE DRINKERS	COFFEE DRINKERS
Sabangan mais 1	3	2
Sabangan mais 2	2	3
Glutinous white	2	2
Sabangan mais 3	3	2
Glutinous yellow	2	2
Popcorn	1	2
Sweet corn hybrid	2	1
Sweet corn native	2	2
Lagkitan Kibungan	2	2
Gasilang	5	1
Rice (check)	1	3
Soybean (check)	2	1
CV (%)	15.61	15.96

Rating scale: 1-liked very much, 2-liked moderately, 3- neither liked nor disliked, 4-disliked moderately, 5-disliked very much

Frequency of Acceptability

All (100%) the non coffee drinkers preferred corn coffee processed from Popcorn over the other varieties (Table 8). Eighty percent of the non coffee drinkers rated corn coffee processed from Glutinous yellow as liked moderately. The non coffee drinkers may have preferred corn coffee processed from Popcorn due to its moderately bitter taste and slight aroma.

Most of the coffee drinkers (60 %) gave the highest rating to corn coffee processed from Sweetcorn hybrid, Gasilang, and Soybean due to the strong aroma, moderately bitter taste, and dark brown color of the beverages.

Table 8. Frequency of acceptability of corn coffee processed from different corn varieties

TREATMENT	FREQUENCY (%)			
	NON COFFEE DRINKERS		COFFEE DRINKERS	
	LIKED MODERATELY	LIKED VERY MUCH	LIKED MODERATELY	LIKED VERY MUCH
Sabangan mais 1	20	0	20	0
Sabangan mais 2	40	0	20	0
Gkutinous white	60	0	40	20
Sabangan mais 3	20	20	80	20
Glutinous yellow	80	0	80	0
Popcorn	0	100	40	20
Sweetcorn hybrid	40	0	20	60
Sweetcorn native	60	20	40	20
Lagkitan Kibungan	40	20	60	0
Gasilang	0	0	20	60
Rice (check)	20	60	20	20
Soybean (check)	60	20	20	60

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SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study was conducted to determine the suitability of different corn varieties as an alternate to rice and soybean coffee and to identify the corn variety with the best cup quality based on aroma, color, taste and acceptability.

The results showed that highly significant differences were observed in the dry matter content (DMC) of the corn varieties. Glutinous yellow obtained the highest DMC and Soybean obtained the lowest DMC.

There are highly significant differences in terms of sugar content of the corn varieties. Lagkitan Kibungan obtained the highest sugar content and Sabangan mais 3 obtained the lowest sugar content.

In terms of ground roasted kernel recovery, Glutinous Yellow had the highest followed by Popcorn, Gasilang and Sweet corn hybrid.

As to the sensory evaluation, corn coffee processed from Gasilang was rated as having a strong aroma by coffee and non coffee drinkers. It was also liked very much by coffee drinkers but disliked very much by non coffee drinkers. Most of the varieties were rated as moderately bitter by coffee and non coffee drinkers. Corn coffee processed from Sabangan mais 1 was rated as very bitter while no bitter taste was found in Sabangan mais 2 and Rice.

Non coffee drinkers rated most of the corn coffee processed from corn varieties as having dark to very dark brown color while corn coffee processed from Rice, Sabangan mais 1, and Glutinous white were rated as light brown. For the coffee drinkers

most of the corn coffee processed from corn varieties were evaluated as light to dark brown while corn coffee processed from Sabangan mais 3 was rated as very dark brown.

Corn coffee processed from Soybean, Gasilang, and Sweetcorn hybrid were liked very much by coffee drinkers. The non coffee drinkers, on the other hand, preferred coffee from Popcorn and Rice.

Conclusions

Based on the results, Glutinous yellow and Gasilang had the highest kernel dry matter content, while Lagkitan Kibungan and Sweetcorn Hybrid had the highest kernel sugar content. In addition, Rice and Lagkitan Kibungan gained the highest percent ground roasted kernel recovery which may lead to higher profit.

Corn coffee processed from Sweetcorn Hybrid, Gasilang, and Soybean were liked very much by coffee drinkers due to its strong aroma, moderately bitter taste, and dark brown color. Corn coffee processed from Popcorn and Rice, on the other hand, were liked much by non coffee drinkers probably due to its slight aroma, moderately bitter taste, and dark brown color.

Recommendations

Gasilang and Sweet Corn Hybrid are recommended as coffee substitutes due to its high dry matter and sugar contents, and high kernel recovery. Both varieties are also recommended as rice and soybean coffee substitutes for coffee drinkers. Popcorn may be recommended as rice and soybean coffee substitute for non coffee drinkers.

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APPENDICES

Appendix Table 1. Dry matter content

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
Sabangan mais 1	14.5	14.0	14.8	43.3	14.4[c]
Sabangan mais 2	14.5	15.0	15.0	44.5	14.8[bc]
Glutinous white	15.1	15.1	14.7	44.9	15.0[b]
Sabangan mais 3	14.9	14.8	16.0	45.7	15.2[b]
Glutinous yellow	16.2	18.9	16.1	51.2	17.1[a]
Popcorn	12.3	12.4	12.7	37.4	12.5[f]
Sweet corn hybrid	14.5	14.2	14.4	43.1	14.4[c]
Sweet corn native	12.8	12.9	12.7	38.4	12.8[ef]
Lagkitan Kibungan	13.4	13.2	13.5	40.1	13.4[d]
Gasilang	16.1	16.0	16.1	48.2	16.1[a]
Rice (check)	13.0	13.1	13.0	39.1	13.0[e]
Soybean (check)	11.2	11.6	11.3	34.1	11.4g
TOTAL	168.5	171.2	170.3	510	170.0

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.215	0.141			
Treatment	11	6.543	2.846	88.95**	2.26	3.18
Error	22	0.074	0.204			
TOTAL	35					

**= Highly significant Coefficient of Variation (%) =1.93

Appendix Table 2. Sugar content

ENTRY	BLOCK			TOTAL	MEAN
	I	II	III		
Sabangan mais 1	2.4	2.6	2.5	7.5	2.5[cd]
Sabangan mais 2	2.7	2.6	2.7	8	2.7[c]
Glutinous white	3.7	3.8	3.7	11.2	3.7[b]
Sabangan mais 3	1.4	1.6	2.5	5.5	1.8[d]
Glutinous yellow	4.1	4.0	4.0	12.1	4.0[ab]
Popcorn	4.3	4.3	4.3	12.9	4.3[ab]
Sweet corn hybrid	3.6	6.1	3.7	13.4	4.5[ab]
Sweet corn native	4.3	4.2	4.4	12.9	4.3[ab]
Lagkitan Kibungan	4.8	4.8	4.8	14.4	4.8[a]
Gasilang	4.4	4.4	4.5	13.3	4.4[ab]
Rice (check)	3.8	3.8	3.7	11.3	3.8[b]
Soybean (check)	2.6	2.5	2.5	7.6	2.5[cd]
TOTAL	42.1	44.7	43.3	130.1	43.4

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.282	0.141			
Treatment	11	31.310	2.846	13.94**	2.26	3.18
Error	22	4.491	0.204			
TOTAL	35	103.439				

**= Highly significant Coefficient of Variation (%) =12.50

Appendix Table 3. Percent ground roasted kernel recovery

Variety	BLOCK			TOTAL	MEAN
	I	II	III		
Sabangan mais 1	18.7	19.9	18.6	57.2	19.2[c]
Sabangan mais 2	19.2	18.7	19.0	56.9	19.0[cd]
Glutinous white	19.1	19.0	18.8	56.9	19.0[cd]
Sabangan mais 3	18.4	18.2	18.2	54.8	18.3[e]
Glutinous yellow	21.8	20.8	21.8	64.4	21.5[a]
Popcorn	21.4	21.4	21.3	64.1	21.4[a]
Sweet corn hybrid	19.7	19.2	19.6	58.5	19.5[a]
Sweet corn native	17.3	18.0	17.4	52.7	17.6[c]
Lagkitan Kibungan	17.3	17.2	17.4	51.9	17.3[f]
Gasilang	20.5	20.6	20.6	61.7	20.6[f]
Rice (check)	15.4	15.3	15.3	46	15.3[b]
Soybean (check)	18.2	18.8	18.1	55.1	18.4[g]
TOTAL	227	227.1	226.1	680.2	226.7[de]

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Block	2	0.051	0.025			
Treatment	11	100.772	9.161	77.04**	2.26	3.18
Error	22	2.616	0.119			
TOTAL	35	103.439				

**= Highly significant Coefficient of Variation (%) =1.83

Appendix Table 4. Aroma of the non coffee drinkers from corn coffee processed from different corn varieties

TREATMENT	NON COFFEE DRINKERS					TOTAL	MEAN
	I	II	III	IV	V		
Sabangan mais 1	4	3	3	2	1	13	3
Sabangan mais 2	4	1	3	3	2	13	3
Glutinous white	2	4	4	1	3	14	3
Sabangan mais 3	3	4	2	1	4	14	3
Glutinous yellow	3	3	1	3	4	13	3
Popcorn	2	2	1	2	4	11	3
Sweet corn hybrid	1	2	4	4	3	14	4
Sweet corn native	3	3	1	4	2	14	3
Lagkitan Kibungan	2	3	3	1	4	13	3
Gasilang	4	4	4	4	4	20	4
Rice (check)	1	3	2	2	3	11	3
Soybean (check)	3	2	2	2	4	13	4
TOTAL	32	37	30	28	38	165	33

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	4	12.433	3.108			
Treatment	11	2.933	0.267	0.2^{ns}	2.01	2.68
Error	44	47.567	1.081			
TOTAL	59	62.933				

^{ns}= not significant Coefficient of Variation (%) =18.25

Appendix Table 5. Aroma of the coffee drinkers from corn coffee processed from different corn varieties

TREATMENT	COFFEE DRINKERS					TOTAL	MEAN
	I	II	III	IV	V		
Sabangan mais 1	3	3	2	1	4	13	3
Sabangan mais 2	1	3	3	4	2	13	3
Glutinous white	2	2	4	2	3	13	3
Sabangan mais 3	1	2	3	4	3	13	3
Glutinous yellow	3	2	3	1	4	13	3
Popcorn	4	3	2	1	3	13	3
Sweet corn hybrid	4	4	4	4	4	20	4
Sweet corn native	3	3	3	1	4	14	3
Lagkitan Kibungan	3	3	2	2	3	13	3
Gasilang	4	4	4	4	4	20	4
Rice (check)	3	3	3	2	2	13	3
Soybean (check)	4	4	3	4	4	19	4
TOTAL	35	36	26	30	40	177	35

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	4	1.833	0.458			
Treatment	11	16.333	1.485	1.41^{ns}	2.01	2.68
Error	44	46.167	1.049			
TOTAL	59	64.333				

^{ns}= not significant Coefficient of Variation (%) =17.33

Appendix Table 6. Taste of the non coffee drinkers from corn coffee processed from different corn varieties

TREATMENT	NON COFFEE DRINKERS					TOTAL	MEAN
	I	II	III	IV	V		
Sabangan mais 1	3	3	2	2	3	13	3
Sabangan mais 2	2	2	2	1	3	10	2
Glutinous white	2	2	1	3	4	12	2
Sabangan mais 3	3	2	3	4	1	13	3
Glutinous yellow	2	2	3	1	4	12	2
Popcorn	2	3	1	2	2	10	2
Sweet corn hybrid	2	2	1	4	3	12	2
Sweet corn native	2	2	1	3	2	10	2
Lagkitan Kibungan	3	3	3	3	2	14	3
Gasilang	3	3	3	3	1	13	3
Rice (check)	2	2	1	1	3	9	2
Soybean (check)	2	2	2	3	1	10	2
TOTAL	28	28	23	30	29	138	28

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	4	3.267	0.817			
Treatment	11	5.383	0.489	0.64^{ns}	2.01	2.68
Error	44	33.533	0.762			
TOTAL	59	42.183				

^{ns}= not significant Coefficient of Variation (%) =16.39

Appendix Table 7. Taste of the coffee drinkers from corn coffee processed from different corn varieties

TREATMENT	COFFEE DRINKERS					TOTAL	MEAN
	I	II	III	IV	V		
Sabangan mais 1	3	3	2	2	2	13	3
Sabangan mais 2	1	1	2	1	1	6	1
Glutinous white	2	2	2	1	3	10	2
Sabangan mais 3	1	2	2	2	2	9	2
Glutinous yellow	1	4	2	3	2	12	2
Popcorn	2	2	1	4	3	12	2
Sweet corn hybrid	2	2	2	3	1	10	2
Sweet corn native	3	3	3	1	1	11	2
Lagkitan Kibungan	2	2	1	4	3	12	2
Gasilang	3	1	3	1	3	11	2
Rice (check)	2	2	1	1	1	7	1
Soybean (check)	4	2	2	2	2	12	2
TOTAL	26	26	24	25	24	125	25

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	4	0.933	0.233			
Treatment	11	15.783	1.435	1.78^{ns}	2.01	2.68
Error	44	35.457	0.806			
TOTAL	59	52.183				

^{ns}= not significant Coefficient of Variation (%) =16.18

Appendix Table 9. Color of the non coffee drinkers from corn coffee processed from different corn varieties

TREATMENT	NON COFFEE DRINKERS					TOTAL	MEAN
	I	II	III	IV	V		
Sabangan mais 1	4	4	3	4	3	18	4
Sabangan mais 2	3	3	3	2	2	13	3
Glutinous white	1	2	3	3	4	13	3
Sabangan mais 3	4	4	4	2	4	18	4
Glutinous yellow	3	3	3	2	2	13	3
Popcorn	3	1	3	3	3	13	3
Sweet corn hybrid	3	2	3	3	2	13	3
Sweet corn native	1	3	4	3	3	14	3
Lagkitan Kibungan	4	4	4	4	2	18	4
Gasilang	3	4	4	4	3	18	4
Rice (check)	3	3	2	1	4	13	3
Soybean (check)	3	1	3	2	4	13	3
TOTAL	35	34	39	33	36	177	35

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	4	1.433	0.358			
Treatment	11	8.583	0.780	0.68^{ns}	2.01	2.68
Error	44	50.167	1.140			
TOTAL	59	60.183				

^{ns}= not significant Coefficient of Variation (%) =16.38

Appendix Table 10. Color of the coffee drinkers from corn coffee processed from different corn varieties

TREATMENT	COFFEE DRINKERS					TOTAL	MEAN
	I	II	III	IV	V		
Sabangan mais 1	4	4	4	4	2	18	4
Sabangan mais 2	3	3	1	3	2	12	2
Glutinous white	3	1	2	3	4	13	3
Sabangan mais 3	3	1	3	3	3	13	3
Glutinous yellow	1	2	3	3	4	13	3
Popcorn	3	3	3	1	3	13	3
Sweet corn hybrid	1	2	4	3	3	13	3
Sweet corn native	2	2	2	2	1	9	2
Lagkitan Kibungan	3	3	1	2	4	13	3
Gasilang	3	1	2	3	4	13	3
Rice (check)	2	2	1	3	2	10	2
Soybean (check)	2	2	3	3	3	13	3
TOTAL	30	26	29	33	35	153	31

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	4	4.433	1.108			
Treatment	11	5.383	0.489	0.48^{ns}	2.01	2.68
Error	44	44.367	1.008			
TOTAL	59	54.183				

^{ns}= not significant Coefficient of Variation (%=16.97

Appendix Table 11. General acceptability of the non coffee drinkers from corn coffee processed from different corn varieties

TREATMENT	NON COFFEE DRINKERS					TOTAL	MEAN
	I	II	III	IV	V		
Sabangan mais 1	2	3	3	3	2	13	3
Sabangan mais 2	2	2	3	1	4	12	2
Glutinous white	2	2	3	2	1	10	2
Sabangan mais 3	3	3	2	3	4	15	3
Glutinous yellow	3	2	3	2	2	11	2
Popcorn	1	1	1	1	1	5	1
Sweet corn hybrid	2	2	4	2	1	12	2
Sweet corn native	2	2	4	2	2	12	2
Lagkitan Kibungan	2	3	2	2	2	16	2
Gasilang	5	5	3	5	5	23	5
Rice (check)	1	1	1	3	1	11	1
Soybean (check)	3	2	2	3	2	12	2
TOTAL	27	29	31	32	30	149	30

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	4	2.767	0.692			
Treatment	11	30.850	2.805	2.85^{ns}	2.01	2.68
Error	44	43.233	0.983			
TOTAL	59	76.850				

^{ns}= not significant Coefficient of Variation (%) =15.61

Appendix Table 12. General acceptability of the coffee drinkers corn coffee processed from different corn varieties

TREATMENT	COFFEE DRINKERS					TOTAL	MEAN
	I	II	III	IV	V		
Sabangan mais 1	2	2	3	2	3	12	2
Sabangan mais 2	3	3	3	3	2	14	3
Glutinous white	2	2	3	4	1	12	2
Sabangan mais 3	2	2	2	2	3	11	2
Glutinous yellow	1	2	2	2	2	9	2
Popcorn	2	2	3	4	1	12	2
Sweet corn hybrid	1	1	2	1	2	7	1
Sweet corn native	1	2	3	2	4	12	2
Lagkitan Kibungan	2	2	2	2	4	12	2
Gasilang	2	1	2	1	1	7	1
Rice (check)	3	3	2	3	2	13	3
Soybean (check)	1	2	1	1	2	7	1
TOTAL	22	24	28	27	27	128	26

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULATED F	
					0.05	0.01
Replication	4	6.600	1.650			
Treatment	11	15.383	1.398	2.04^{ns}	2.01	2.68
Error	44	30.200	0.686			
TOTAL	59	52.183				

^{ns}= not significant Coefficient of Variation (%) =15.96