

BIBLIOGRAPHY

CALVERO, AURORA F. APRIL, 2013. Evaluation of CornCultivars Against Diseases Under La Trinidad Condition, Benguet Condition. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The study was conducted to determine the resistance of different corn cultivars against major corn diseases; and to document the most prevalent and the most severe corn diseases under La Trinidad, Benguet condition.

The most prevalent corn disease was leaf blight caused by *Helminthosporium maydis*, followed by corn rust caused by *Puccinia sorghi*, downy mildew caused by *Peronosclerospora maydis*, and corn smut caused by (*Ustilago maydis*).

Among the corn cultivars evaluated, TSG corn had the lowest leaf blight infection rating while the highest infection was recorded in the Sweet corn cultivar. Meanwhile, Bioseed corn cultivar had the highest infection and Popcorn had the lowest infection rating on downy mildew. Rust infection was the highest in the Sweet corn cultivar while Rr with bio-n, Dekalb, Bioseed and TSG corn were susceptible to smut infection. High infection was due to favorable conditions for disease development. TSG corn cultivar had the highest marketable yield than Popcorn cultivar. Sweet corn cultivar was the most favored in the sensory evaluation than Indigenous corn.



RESULT AND DISCUSSION

Occurrences of Leaf Blight, Downy Mildew and Rust

Based on the leaf blight infection from emergence, Indigenous corn was the first cultivar to be infected at 18.5 days from emergence, while infection of diseases were TSG corn and Rr with bio-n was at 23 days (Table 1).

Downy mildew infection was observed to occur later than leaf blight. Infection was first observed in the cultivar Popcorn at 22.75 days and last to be infected was Rr with bio-n at 26 days from emergence, while Indigenous corn was infected at 23.00 days.

As to rust infection, TSG corn was the first cultivar to be infected at 65.75 days while the last cultivar to be infected was Dekalb at 73 days (Table 1).

The statistical analysis show no significantly difference among all the cultivars in all the diseases observed.

Table 1. Mean number of days from emergence to the initial disease infection

CULTIVARS	LEAF BLIGHT	DOWNY MILDEW	RUST
Indigenous corn (control)	18.50	23.00	72.50
Popcorn	22.75	22.75	70.25
Dekald	21.75	23.75	73.00
Bioseed	21.75	24.25	69.75
Sweet corn	21.00	25.25	69.00
TSG corn	23.00	24.00	65.75
Rr with bio-n	23.00	26.00	66.75



Leaf Blight Infection

Observation of leaf blight infection started 7 days after emergence. Initial infection recorded after 14 days showed that four cultivars had infection of 6.25% and three with 5%, (Table 2). Statistical analysis, however, did not show significant differences among the cultivars.

Weekly leaf blight infection ratings taken from 21 to 91 days from emergence, showed that TSG corn consistently had the least infection rating except on the 49th day where leaf blight infection was slightly higher than the control Indigenous corn. Likewise, Bioseed as the 2nd with low leaf blight final infection rating, showed gradual increase of infection from earlier period of growth, but showed minimal progress of leaf blight infection towards maturity as compared to other cultivars.

Sweet corn had a consistently low leaf blight infection from 21st up to 70th day from emergence, but which increased from 77th day to the last rating period. A trend which implies that sweet corn cultivar become susceptible as it matures, (Figure 2). However, Rr with bio-n had the third least percentage of leaf blight infection rating which was followed by cultivar.

Moreover, Popcorn had the least infection of leaf blight at 21th days of infection, at 42th had the highest infection of leaf blight until reaches its maturity.



Table 2. Weekly mean percentage infection (%)

CULTIVAR	DAYS AFTER PLANTING											
	14	21	28	35	42	49	56	63	70	77	84	91
Indigenous	0	8.75	11.25	16.25	20.75	25.00	30.25	35.75	43.75	50.50	60.75	78.75 ^{ab}
Popcorn	0	8.75	11.25	20.50	26.25	31.50	37.50	48.50	56.75	63.50	70.25	100 ^a
Dekalb	0	8.75	11.25	16.25	22.50	28.75	38.50	45.50	51.50	56.75	58.75	65.25 ^b
Bioseed	0	11.25	16.25	17.75	22.75	25.50	28.75	32.75	35.50	41.25	49.50	55.50 ^{bc}
Sweet corn	0	8.75	11.25	16.25	18.75	24.50	27.75	31.75	39.50	50.50	78.75	100 ^a
TSG corn	0	7.50	10.25	14.75	16.25	21.25	26.75	30.75	34.50	38.5	38.5	43.75 ^c
Rr with bio n	0	8.75	13.75	16.25	20.5	28.75	31.25	35.75	40.25	45.75	50.50	57.00 ^{bc}



Table 3. Mean length of lesion

Cultivars	LENGTH OF LESION (cm)
Indigenous corn	28.99 ^c
Popcorn	23.78 ^{bc}
Dekalb	13.54 ^{ab}
Bioseed	13.10 ^b
Sweet corn	21.52 ^{bc}
TSG corn	9.30 ^a
Rr with Bio-n	14.71 ^{ab}
CV (%)	26.40

Means of the same letter have no significantly different at 5% level of DMRT

Length lesion was observed that TSG corn had significantly the shortest leaf blight lesion at 9.30cm and the longest was Indigenous corn at 28.84mm (Table 2). Result further revealed that cultivars that had lower percentage of leaf blight infection also had significantly shorter length of lesions. Aside from cultivar TSG corn this was exhibit by cultivars Bioseed, Deklalb, and Rr with bio-n.

The prevalence of leaf blight infection was due favored by the temperature during the conduct of the study which ranged from 21.98⁰C to 24.13⁰C (Table 10). These coincide to the report of Jugenheimer (1976) that leaf blight infection is favorable to temperature range of 20°C – 32°C and 89% relative humidity. Actual relative humidity of 86.61% (Table 10), however, does not conform to the 89% as cited.



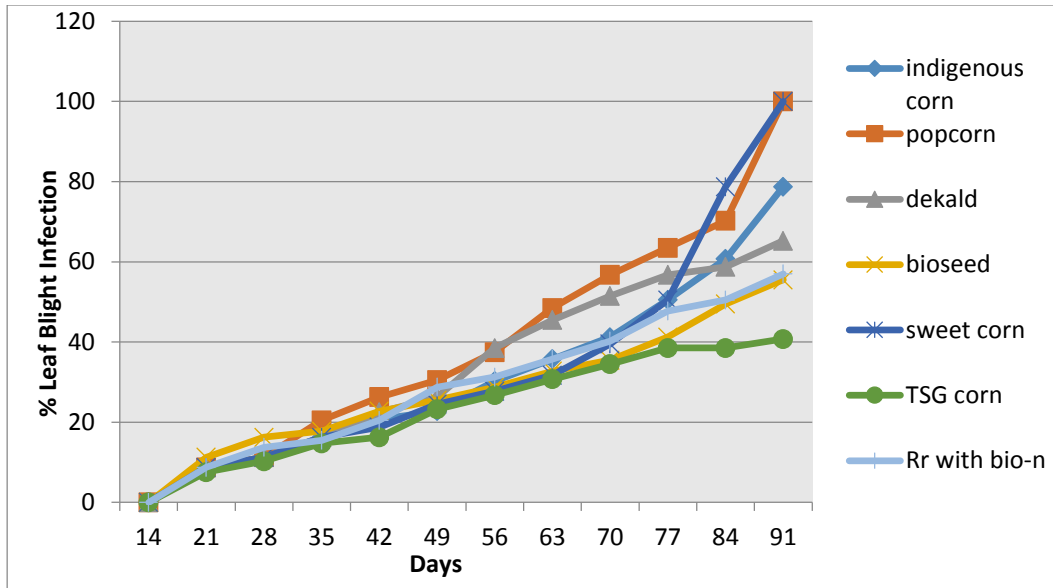


Figure 2. Weekly mean percentage of leaf blight infection

Downy Mildew Infection

The cultivars Sweet corn and Popcorn had the lowest downy mildew infection rating of 8.75 which is significantly lower than infection in other cultivars (Table 4).

The favorable temperature for downy mildew infection is 24⁰C at 89% relative humidity as reported by Cardwell (2000). Such temperature falls within the range of actual temperature during the conduct of the study. However, downy mildew infection was generally low in most of the cultivars. Therefore, infection may have come from seed infections but not from inocula in the field, as downy mildew could be a seed borne disease.



Table 4. Downy mildew infection rating (%)

CULTIVARS	MEAN
Indigenous corn	13.75 ^b
Popcorn	8.75 ^a
Delakb	11.25 ^b
Bioseed	45.00 ^c
Sweet corn	8.75 ^a
TSG corn	10.00 ^{bc}
Rr with bio-n	10.00 ^{bc}
CV (%)	172.23%

Means of the same letter are not significant to 5% level of DMRT

Leaf Rust Infection

The cultivar TSG corn had the lowest infection rating at 8.75%, while Sweet corn had the highest infection rating at 100%. Statistical analysis show significant differences among the cultivars.

The 100% rust infection on sweet corn conforms with the observations in other countries mostly Tropical America and United State of America that Sweet corn is very susceptible to rust infection and damage cause heavy losses to yield (Niedehauser and Barnes, 1955).

The temperature during the conduct of the study ranged from 21.98^oC to 24.13^oC (Table 10) which is within the range reported by Martin et.al., (1992) that rust infection is favorable at high humidity with cool evening temperature of 16-23.33^oC, follow by moderate daytime temperature. Hence, Bioseed cultivar was susceptible to rust infections.

Table 5. Rust infection rating (%)



CULTIVARS	MEAN
Indigenous corn	76.25 ^{bc}
Popcorn	77.50 ^{bc}
Dekalb	15.00 ^b
Bioseed	16.25 ^b
Sweet corn	100.00 ^c
TSG corn	8.75 ^a
Rr with Bio-n	11.25 ^b
CV (%)	37.16

Means of the same letter are not significant to 5% level of DMRT

Smut Diseases

Two pathogens were observed as causal agents of smut diseases. The head smut is caused by *Sphacelotheca reliana*, (Figure 5) and corn smut caused by *Ustilago maydis*, (Figure 6).

The severity of smut diseases occurred in Dekalb, Bioseed, TSG corn and Rr with bio-n. However, among all the cultivars Indigenous corn, Popcorn and Sweet corn were resistant to smut diseases (Table 6).

The low incidence and infection of corn smut diseases could be attributed to the low temperature (21.98⁰C to 24.13⁰C) during the conduct of the study. Koehning, (2005) reported that the smut fungus grows best at a temperature range of 25–34⁰C .



Table 6. Percent incidence of smut infection rating

CULTIVARS	MEAN	
	ACTUAL	TRANSFORMED
Indigenous corn	0	0.71 ^a
Popcorn	0	0.71 ^a
Dekalb	0.93	0.93 ^a
Bioseed	1.29	1.29 ^a
Sweet corn	0	0.71 ^a
TSG corn	1.83	1.83 ^a
Rr with bio-n	2.73	2.73 ^a
CV (%)		106.44

Means of the same letter are not significant to 5% level of DMRT

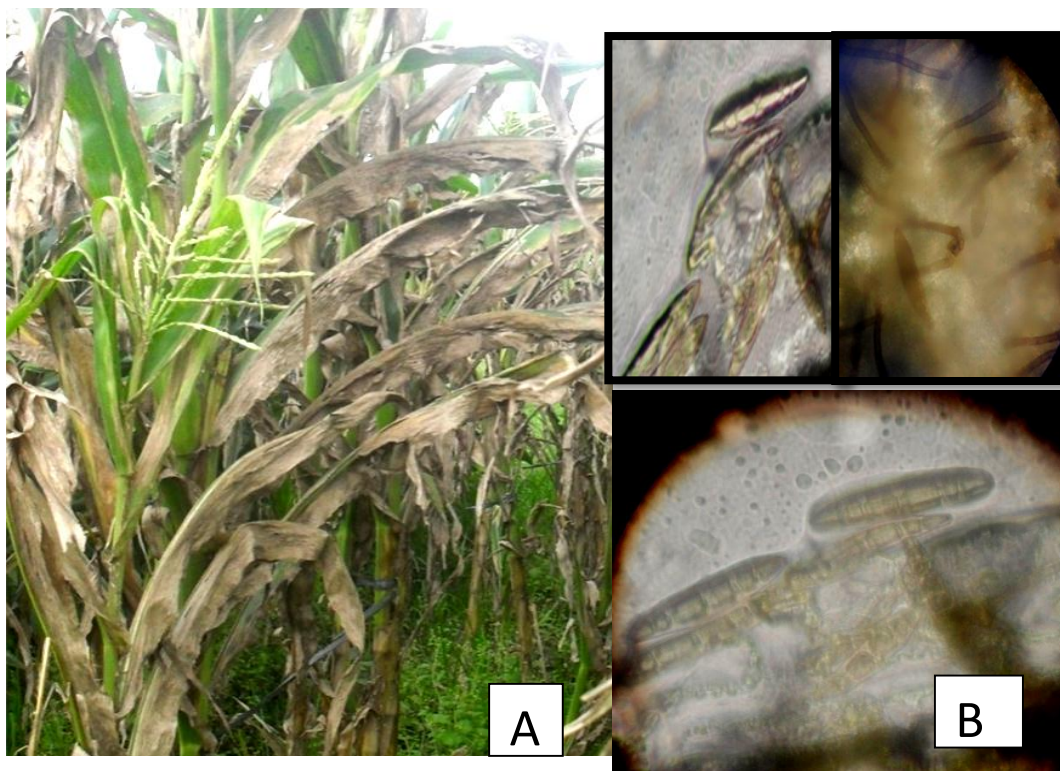


Figure 3. Leaf blight: symptom (A), Conidia, 400X (B)

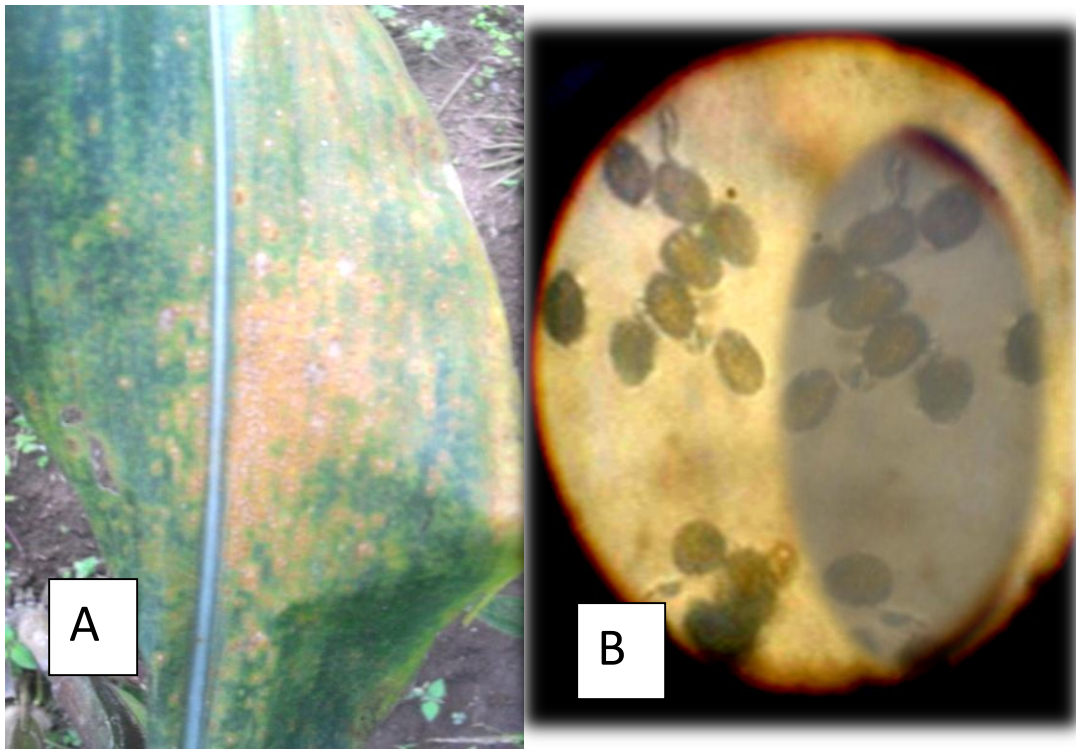


Figure 4. Rust infection; symptom (A), uredospores 400X (B)



Figure 5. Head smut; symptoms (A), teliospores (B) 400X

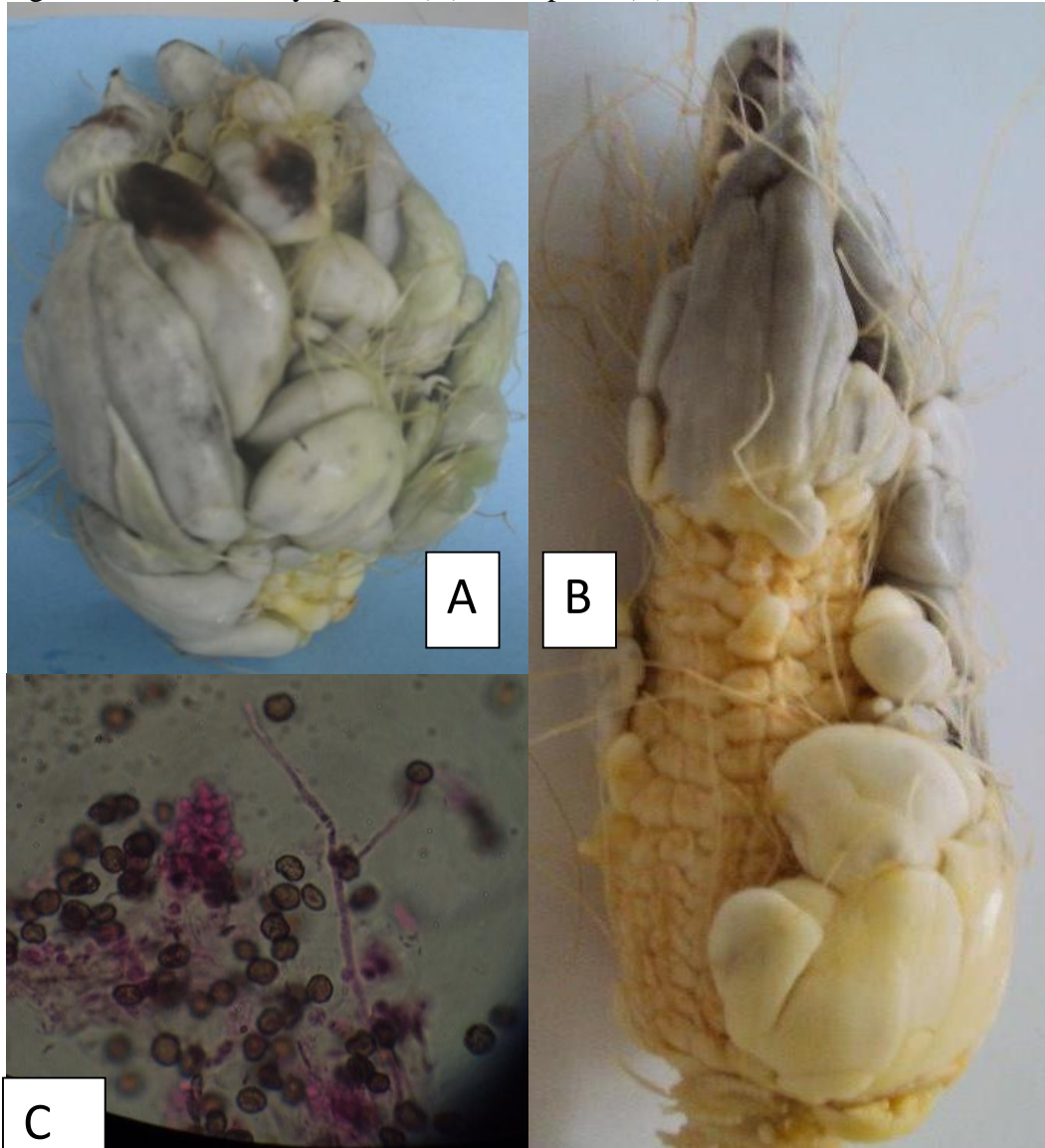


Figure 6. Corn smut ; symptoms (A and B), spores (C) 400X

Agronomic Characteristics

Ear length with and without husk (cm) The longest ear length with husk was obtained on Rr with bio-n the shortest was from Popcorn. However, as to ear length without husk, Dekalb had significantly longer ear length compared to the other cultivars except TSG corn and Rr with bio-n.

Some cultivars have thick husk but do not have long ear. Cultivars with longer ear would generally have a higher yield which would translate to higher income. Statistical analysis show significant difference among all the cultivars.

Table 7. Ear length and diameter

CULTIVARS	EAR LENGTH		EAR DIAMETER	
	W/ HUSK (cm)	W/O HUSK (cm)	W/ HUSK (cm)	W/O HUSK (cm)
Indigenous corn	22.38 ^{ab}	14.68 ^a	5.21 ^c	4.35 ^b
Popcorn	21.49 ^a	15.87 ^{ab}	3.17 ^a	2.72 ^a
Dekalb	23.24 ^{bc}	20.36 ^c	4.88 ^{bc}	4.05 ^b
Bioseed	22.64 ^{ab}	17.33 ^b	4.93 ^{bc}	3.96 ^{ab}
Sweet corn	22.98 ^{ab}	18.15 ^b	5.12 ^b	4.44 ^c
TSG corn	21.68 ^b	19.21 ^{bc}	5.40 ^c	4.18 ^{bc}
Rr w/ Bio-n	23.88 ^c	19.22 ^{bc}	5.04 ^b	4.19 ^{bc}
CV (%)	6.49%	6.03%	7.98%	6.32%

Means with the same letter are not significant to 5% level of DMRT

Ear Diameter with and without Husk (cm)

Aside from having longer ears, TSG corn also had significantly wider ear diameter with husk intact while the cultivar Popcorn had the shortest cobs. Sweet corn had the widest cobs without husk

Corn plants that produce the narrowest ear cobs but a wider diameter with a maximum of 2cm of marketable young corn would mean a higher weight and higher revenue.





Figure 7. Measuring ear length with and without husk

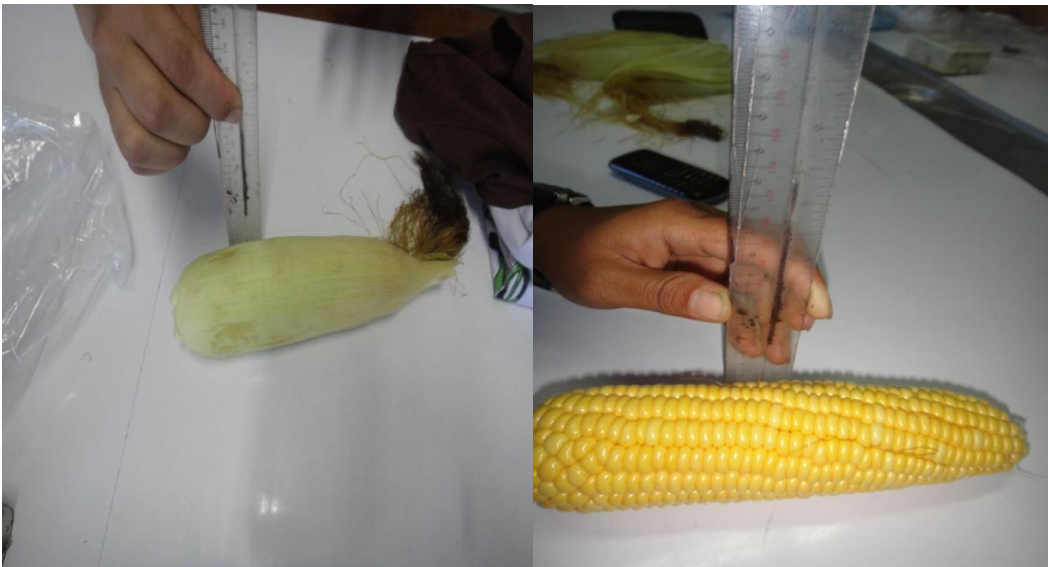


Figure 8. Measuring ear diameter with and without husk

Total Marketable Yield per Plot (kg)

TSG corn had significantly the highest marketable yield with significantly produced the lowest yield which mean of 13.19kg per plot. The cultivars Sweet corn and Popcorn did not out yield the check variety Indigenous corn. It was observed that all the cultivars had significant differences.

Table 8. Total marketable yield per plot (kg)

CULTIVARS	MEAN
Indigenous corn	6.69 ^{bc}
Popcorn	1.99 ^a
Dekalb	9.13 ^{ab}
Bioseed	8.75 ^{ab}
Sweet corn	2.94 ^b
TSG corn	13.19 ^c
Rr with Bio-n	8.94 ^{ab}

Means of the same letter are not significantly different at 5% level of DMRT

Sensory Evaluation

Ten respondents selected randomly from BSU students were asked to evaluate the boiled corn cultivars according to flavor, appearance, palatability, texture, aroma, and general acceptance.

In terms of flavor, Sweet corn cultivar was liked better by the ten respondents. However, Popcorn and Bioseed disliked moderately while other cultivars like moderately according to appearance.



In relation to palatability or taste, Indigenous corn was considered the most delicious followed by Sweet corn. Young cobs of Popcorn were disliked moderately. Considering the ratings in all the parameters Sweet corn was liked better than Indigenous corn.

Table 9. Sensory evaluation of the different corn cultivars

CULTIVARS	PARAMETERS					
	FLAVOR	APPEARANCE	PALATABILITY	TEXTURE	AROMA	GENERAL ACCEPTANCE
Indigenous corn	4.4	4.3	4.4	4.3	4.4	4.36
Popcorn	2.1	2.6	2.3	2.6	2.3	2.38
Dekalb	2.9	3.6	2.9	3.0	3.0	3.08
Bioseed	2.8	2.9	3.5	3.5	3.1	3.0
Sweet corn	4.6	4.2	4.2	4.3	4.4	4.34
TSG corn	3.3	4.1	3.4	3.5	3.6	3.58
Rr with Bio-n	3.8	3.8	3.5	3.6	3.9	3.72

- Scale: 1- Dislike very much
2- Dislike moderately
3- Neither like nor dislike
4- Like moderately
5- like very much



Meteorological Data

Table 10. Average meteorological data from April to July, 2012

Date	TEMPERATURE		RELATIVE HUMIDITY	RAINFALL
	MIN	MAX	(%)	(mm)
April	19.70	25.23	81.25	1.83
May		24.40	87.75	17.80
June	22.75	23.98	88.50	10.95
July	22.88	23.88	89.00	13.05



SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study was conducted at Benguet State University, La Trinidad, Benguet from April to July, 2012. The study aimed to determine the resistance of different corn cultivars against major corn diseases; and to document the most prevalent and the most severe corn diseases under La Trinidad, Benguet condition.

The corn diseases that were observed to be prevalent were leaf blight, rust, downy mildew and smut. It was observed that Sweet corn was the most susceptible to leaf blight and rust infection. Bioseed was most susceptible to Downy mildew. Smut infection was observed only in cultivars Rr with bio-n, Dekalb, Bioseed and TSG corn.

TSG corn was observed to be resistant to leaf blight and rust infection while Sweet corn was resistant to downy mildew and Indigenous corn, Popcorn and Sweet corn were resistant to corn smut.

The longest ear length with husk was obtained in Rr with bio-n and the shortest was from Popcorn. The longest ear length without husk was noted from Dekalb and the shortest was from Popcorn.

Meanwhile, TSG corn had larger ear diameter with husk intact and Popcorn had the shortest cobs. Sweet corn had the largest cobs and Popcorn was the smallest.

Conclusions

The results revealed that TSG corn is resistant to leaf blight infection and rust while Bioseed is most susceptible to downy mildew. On the other hand, Sweet corn is the most susceptible to rust infection and Rr with bio-n, Dekalb, Bioseed and TSG corn are most susceptible to smut.



Recommendations

TSG corn cultivar is recommended for planting in La Trinidad, Benguet due to its moderate resistance to leaf blight and rust diseases.

Further, it is recommended that cultivated corn plants should be evaluated and to be done also during dry and rainy season.



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