Effect Of Pipil Corn Varieties On Curvularia Sp Fungal Disease And Diplodia On Dry Land

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Abstract

This study aimed to determine the effect of shelled corn varieties on the severity of Diplodia and Curvularia sp. infections in dryland farming areas. The research was conducted in Kuta Bangun Village, Tigabinanga District, Karo Regency, North Sumatra, from June to October 2025, utilizing 10 corn varieties with three replications. Observed parameters included the severity of Diplodia infection on cobs and Curvularia sp. infection on leaves. Data were analyzed using tests for normality and homogeneity, ANOVA, and the Games-Howell test. The results indicated that the variety had a highly significant effect on the severity of Diplodia and Curvularia sp. infections ($p<0.05$). The ASA#3X variety exhibited the lowest average Diplodia infection (1.9225 cobs), while the Bomber variety showed the highest (8.3689 cobs). Regarding Curvularia sp., the lowest infection levels were observed in the Bomber and NK Fantastis varieties (1.6667 leaves), whereas the highest level was found in NK Perkasa (4.0000 leaves). The findings demonstrate variations in disease resistance levels among the corn varieties.

Keywords: corn, varieties, Diplodia, Curvularia sp., disease resistance

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3rd International Cofference on the Epicentrum of Economic Global Framework (ICEEGLOF)
Theme: Navigating The Future: Business and Social Paradigms in a Transformative Era.
https://proceeding.pancabudi.ac.id/index.php/ICEEGLOF

Introduction

Agriculture, which is the main food producing sector in Indonesia, needs to be improved in order to meet the food needs needed by the community in line with the increasing number of people who continue to grow in order to contribute to realizing sustainable local-based food security as well as becoming a potential source for the development of functional food products [1] . One of the food ingredients whose demand level is high is corn. Corn plants are one of the urtama materials that are in great demand due to the rapid development of the livestock industry, corn is the main component (60%) in feed rations. It is estimated that more than 55% of domestic corn needs are used for feed, while for food consumption around 30%, and the rest for other industrial needs and seeds [2].

In addition to wheat and rice, other carbohydrate-producing foods are corn. In Indonesia, we find a lot of corn fields spread across the country. In Indonesia, the opportunity to increase corn production is still quite large, both through increasing productivity and expanding planting areas on rice fields and dry land. One of the threats to the growth of corn plants in Indonesia is disease disturbances. Diseases that attack corn plants are often found and are familiar to farmers. The disease can cause losses for farmers. This is due to farmers' ignorance of diseases that attack corn plants. So that it results in less early treatment of diseases that attack corn plants. This affects corn production [3].

According to the statement, low corn production at the farmer level can affect production nationally. This may be related to the use of varieties, soil tillage and the density of large unity crops that are not suitable for the growth of corn plants. The increase in the production of corn varieties is one of the determinants. The availability of superior varieties with high yields and resistance to major pests and diseases, especially [4] Curvularia sp and Diplodia diseases is very necessary.

Cob rot Diplodia maydis (Barkeley) Saccardo is a common disease in corn in the world. This pathogen attacks the cob so that decay occurs. The decay usually develops from the base to the tip of the cob and then spreads to the surface of the seed and covers the buds. The cob becomes rotten and the cob sticks tightly to each other [5].

Leaf blight disease (Bipolaris maydis) is one of the important diseases of corn plants that attacks the leaves, high attacks can affect the production yield of the fungus Exserohilum turcicum which causes yield loss of up to 70%. As well as leaf spot disease caused by pathogens (Curvularia sp) which is an important disease for corn plants that can reduce crop yields. To control pests and diseases of corn, it is recommended to use control components which include: resistant varieties, technical cultures, natural enemies and perticides[6].

The most common important disease control in corn crops is the use of resistant varieties and fungicides with active ingredients Azoxicitopin and Mancozeb. The use of resistant varieties is one of the most effective components in their control strategy. Another thing is that the continuous use of one variety will cause the emergence of new varieties of mildew that are more virulent, so that varieties that are resistant usually after being planted for several seasons will experience a decrease in resistance. This study aims to test the disease resistance of pipil corn plants caused by [7] Diplodia and Curvularia sp fungi in Tigabinanga District, Karo Regency.

Literature Review

Genetic and environmental factors greatly affect the performance of corn seeds. Corn has a wide variety of varieties providing diverse growth and production. This is in line with the opinion that plant growth is influenced by two factors, namely the internal factor ([8] *ternal factor*) which is the nature of the plant (seed) and the environmental factors (*environmental factors*) of the external nature of the plant. Plants to the environment, one of which is characterized by a physiological response. This is closely related to plant productivity because there are changes in physiological mechanisms that will be the key to the phenotype and productivity produced.

Corn plant varieties have a role in disease resistance because corn plants have different tissue thicknesses for each variety. In the study, it was stated that resistant varieties have the lowest stomata density of 65.353/mm [9] ^{2}, and the highest stomata density is possessed by susceptible varieties, namely sweet corn with a density of 110.79/mm^2. The density of the stomata is positively correlated with disease intensity.

Diplodia *cob rot* is a common disease in corn in the world. This pathogen attacks the cob so that decay occurs. The decay usually develops from the base to the tip of the cob and then spreads to the surface of the seed and covers the buds. The cob becomes rotten and the cob sticks tightly to each other. In addition to the cob, this fungus can also infect the leaf fronds, extending to the book and the base of the stem segment. Stem rot starts from a wound on the fronds (where the adventitious roots come out). This disease attack causes complex infections, namely cob rot, leaf rot, and diseases in the seedbed. Control efforts that have been carried out to reduce cob rot disease are the use of synthetic fungicides, but the continuous use of synthetic fungicides and applied not in accordance with recommendations can leave residues that harm the environment and increase pathogen resistance. Another control is by crop rotation, the use of resistant varieties and biological agents. [10]

One of the leaf diseases that have reportedly attacked corn plants is leaf spot caused by fungi of the genus *Curvularia* sp, especially *Curvularia* sp lunata. Severe infection *of Curvularia* sp can cause significant yield loss, especially if the attack occurs in the early stages of plant growth. The severity of the disease is influenced by the interaction between the pathogen, the host, and the environment. Corn varieties that have better genetic resistance show lower attack intensity than susceptible varieties. One of the sources of research states that the symptoms of [11] *Curvularia* sp leaf spot disease vary between corn varieties, and certain varieties are categorized as resistant, intermediate, or susceptible to the disease based on the size and shape of lesions on corn leaves. This suggests that the genetics of corn varieties influence their response to the *pathogenic attack Curvularia* sp lunata.

Methods

This research was conducted in Kuta Bangun Village, Tiga Binanga District, Karo Regency, North Sumatra with an altitude of ±600 meters above sea level, which will be carried out in June-October 2025. The materials used are corn seeds consisting of 8 varieties, insecticides to overcome caterpillar pests, NPK 16-16-16 fertilizer, Urea, SP-26 and KCL, Ecoenzymes for additional nutrients in the leaves. The tools used are tugal wood, raffia rope, meter, stake wood, water reservoir drum, and stationery.

3.1 Plot Making

First, the creation of 30 research plots consisting of 3 blocks. Where each repetition consists of 10 plots. The plot size used is 5 m x 2.1 m, with a distance between plots of 0.7 m and a distance between blocks of 1 m.

3.2 Planting Seeds

Seed planting is done by planting in a planting hole that has been made 2-3 cm deep with a planting distance of 70 x 20 cm. Seeds are put into the planting hole as many as 1

seed per planting hole, then covered again with loose soil around the hole. The corn varieties used in this study are Bomber, NK Fantastis, Elite R, P32, Dahsyat, WS407, NKGaruda, ASA#3X, NK Sumo and NK Perkasa.

3.3 Application of Ecoenzymes to Corn Crops

The application of ecoenzymes is carried out on plants aged starting from 2 mst old plants as much as 3 ml/lt of water. Ecoenzymes are done byspraying directly onto plant leaves.

3.4 Observation of leafy scallops (*Curvularia* sp)

Observation *of Curvularia* sp is carried out when the plant is 70 days old after planting the perplot, and the leaves that are considered infected with *the fungus Curvularia* sp have characteristics such as brown spots that appear on the surface of the leaves

3.5 Harvest

Harvesting is carried out at the age of 4 months after planting. The right harvest time is when the bark and leaves are dry and the corn kernels do not leave marks when massaged and harvested in the morning.

3.6 Observation of *the fungus Diplodia*

Observation of *Diplodia* mushrooms is carried out after harvest and *Diplodia* mushrooms have characteristics such as brownish-white fine threads that cover corn cobs. Cobs infected [12] *with Diplodia* are then counted per plot.

3.7 Data analysis

The normality test is performed to find out whether in the regression model, the dependent and independent variables both have a normal or close to normal distribution. Next, the homogeneity test was used to see if the varieties of *Diplodia* and *Curvularia* sp fungi attack rate on each corn variety had the same diversity. Furthermore, data analysis was conducted using the ANOVA test. ANOVA testing is performed to see if there is an influence of the variety on each parameter studied. The ANOVA test is used to find out whether or not there is an average difference between groups of varieties. A good analysis model is shown by the presence of a significance value of < 0.05, so it can be concluded that the variety exerts a significant influence on the observed parameters. Then the Games-Howell test notation is used to look at the groups of varieties that have a real difference based on the average yield value of the variety.

Result and Discussion

4.1. Normality Test

The normality test is performed to find out whether in the regression model, the dependent and independent variables both have a normal or close to normal distribution.

Image 1. One-Sample Kolmogorov-Smirnov Test

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		30
Normal Parameters[a,b]	Mean	,0000000
	Std. Deviation	1,79037322
Most Extreme Differences	Absolute	,149
	Positive	,130
	Negative	-,149
Test Statistic		,149
Asymp. Sig. (2-tailed)		,087[c]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Based on the table above, it is known that the number (N) in this study is 30. This table shows that the data has been distributed normally with a significance level (asym.sig 2-tailed) of 0.087 which is above 0.05 so that it can be concluded that the regression model in this study meets the normality assumption test. This shows that the hypothesis that states the data is abnormal is rejected and accepts the hypothesis that the data is normal.

4.2. Homogeneity Test

The homogeneity test was used to see if the varieties of Diplodia and Curvularia sp fungi attack in each corn variety had the same diversity.

Table 1. Homogeneity Test of Fungal Attack Rate Diplodia and Curvularia sp

Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Say.
Diplodia	Based on Mean	4,713	9	20	,002
Curvularia sp	Based on Mean	13,037	9	20	,000

The results of the homogeneity test using Levene's Test showed that the Diplodia variable had a significance value of 0.002 and Curvularia sp of 0.000. Both values are smaller than 0.05, so it can be concluded that the data do not meet the assumption of homogeneity of variance (non-homogeneity).

4.3. Influence of Variety on Paramater (ANOVA)

ANOVA testing is performed to see if there is an influence of the variety on each parameter studied. The ANOVA test is used to find out whether or not there is an average difference between groups of varieties. A good analysis model is shown by the presence of a significance value of < 0.05, so it can be concluded that the variety exerts a significant influence on the observed parameters.

Table 2. ANOVA Test on the Effect of Varieties on Fungi Diplodia and Curvularia sp.

ANOVA

		Sum of Squares	df	Mean Square	F	Say.
Diplodia	Between Groups	176,761	9	19,640	6,008	,000
Curvularia sp	Between Groups	13,367	9	1,485	7,426	,000

Based on the results of the ANOVA test in the table above, it is known that the Diplodia Length variable has a significance value of 0.000 < 0.05 with an F value of 6.008. This shows that the variety has a significant effect on the Diplodia fungus, so there is a difference in the average attack of Diplodia fungus in each variety tested. In the Curvularia sp variable, a significance value of 0.000 < 0.05 was obtained with an F value of 7.426. These results show that varieties have a significant effect on Curvularia sp, so there are differences in Curvularia sp fungus attacks between varieties. Thus, it can be concluded that varieties have a significant effect on disease, so there are differences in disease resistance between the varieties tested. Since homogeneity was not met, the follow-up test used was Games Howell.

The results of the analysis showed that corn varieties had a significant influence on the attack rate of Diplodia and Curvularia sp. This is evidenced by the results of the

ANOVA test which showed a significance value of less than 0.05 in both disease parameters. Thus, there was a difference in the rate of disease attack between the corn varieties tested. These differences show that each variety has a different response to pathogenic infections, so the level of resistance they have is also different. The difference in the rate of disease attack between varieties is suspected to be due to differences in the genetic ability of each variety to inhibit the development of pathogens. Varieties that have resistance genes tend to show lower attack intensity than susceptible varieties. These findings are in line with research that states that each variety has a different resistance response to pathogenic infections, resulting in different levels of disease attacks [13].

4.4. Average Diplodia Fungal Attack (Cob) Per Variety and Games-Howell Test Notation

The results of the Games-Howell further test showed that there were significantly different groups of varieties in the rate of Diplodia attack. These results reinforce the findings in the ANOVA test that the influence of varieties on Diplodia attacks is not only statistically significant, but also results in significant differences between groups of varieties. Therefore, selecting varieties that have a low attack rate can be one of the strategies to reduce losses due to Diplodia disease. Table 3. Average Fungal Attack Diplodia (cob) Per Variety and Test Notation Games-Howell

		N	Mean
Diplodia (Tongkol)	Bomber	3	8,3689
	NK Fantastic	3	5,8156
	Elite R	3	7,9547
	P32	3	2,0438
	Dahsyat	3	2,0936
	WS407	3	2,1434
	NKGaruda	3	2,8815
	ASA#3X	3	1,9225
	NK Sumo	3	4,7929
	NK Perkasa	3	2,0524
	Total	30	4,0069

Based on the results of observations of Diplodia fungi, it is known that each corn variety shows a different average attack of Diplodia fungi. The variety with the highest average attack of Diplodia fungus is Bomber with 8.3689 cobs, followed by Elite R with 7.9547 cobs and NK Fantastic with 5.8156 cobs. These results show that the three varieties have lower disease resistance than other varieties in the conditions of research conducted on dry land. The high level of susceptibility allows pathogens to develop faster so that the number of infected cobs becomes more. The high number of infected cobs is thought to be due to the level of susceptibility of the variety to pathogens. Susceptible varieties have a lower ability to inhibit infection and pathogen development, so pathogen colonization takes place faster and results in an increase in the number of infected cobs. stated that susceptible corn genotypes showed higher development of cob rot than resistant genotypes. These results are supported by a study that found that susceptible corn strains have a higher severity of cob blight than resistant strains. [14]

Meanwhile, the variety with the lowest average Diplodia fungal attack was ASA#3X of 1.9225 cobs, then P32 of 2.0438 cobs. The low attack of Diplodia fungus

in each of these varieties indicates that the variety is more resistant to Diplodia fungus attack in dry land. The Dahsyat variety produced an average of 2.0936 cobs of Diplodia fungus, while WS407 amounted to 2.1434 cobs, NKGaruda amounted to 2.8815 cobs, and NK Sumo amounted to 4.7929 cobs, while NK Perkasa amounted to 2.0524 cobs. Overall, the average attack of Diplodia fungus of all varieties was 4.0069 cobs. The total average value indicates that some varieties have resistance to Diplodia fungal attacks. The varieties with the lowest Diplodia fungal infestation are ASA#3X, P32, Dahsyat, WS407, and NK Perkasa. The low rate of Diplodia attack on the variety indicates that the variety has a better level of resistance to pathogens. The resistance of the variety allows the plant to inhibit infection and fungal development so that the number of infested cobs is lower. which shows that the resistant corn genotype has a lower intensity of disease attack than the susceptible genotype. Therefore, the low attack [16] of Diplodia in this study is thought to be related to the higher level of resistance of the variety to dryland conditions during the study**.**

4.5. Average Attack of Curvularia sp (strands) Per Variety and Test Notation Games-Howell

The results of the Games-Howell test on the Curvularia sp parameter show the existence of groups of varieties that are markedly different from each other. These results are in line with the ANOVA test which shows that the variety has a significant effect on the rate of Curvularia sp. Thus, variety is one of the important factors that need to be considered in efforts to control leaf disease in corn plants. Table 4. Average Fungal Attack Curvularia sp (strand) Per Variety and Test Notation Games-Howell Curvularia sp.

		N	Mean
Curvularia sp (helai)	Bomber	3	1,6667
	NK Fantastic	3	1,6667
	Elite R	3	2,3333
	P32	3	3,0000
	Dahsyat	3	3,0000
	WS407	3	3,0000
	NKGaruda	3	3,0000
	ASA#3X	3	3,0000
	NK Sumo	3	3,0000
	NK Perkasa	3	4,0000
	Total	30	2,7667

Based on the results of the average attack rate of Curvularia sp fungus (strands) in each variety, it is known that the Bomber and NK Fantastic varieties have the lowest average Curvularia sp fungus attack of 1.6667 strands and followed by the Elite R variety of 2.3333 strands. Meanwhile, the NK Perkasa variety has the highest average rate of attack of the Curvularia sp fungus, which is 4.0000 leaves. In the P32, Dahsyar, WS407, NK Garuda, ASA#3X, and NK Sumo varieties have an average of 3,0000 Curvularia sp fungus attacks. The average overall rate of Curvularia sp fungi of all varieties was 2.7667 leaves. Based on the results of the previous ANOVA test, the difference in the average attack of Curvularia sp fungus between varieties showed a significant influence. The difference in the rate of attack of Curvularia sp between varieties shows that variety factors play an important role in determining the severity of the disease. In addition, environmental conditions during the study can also affect the intensity of disease attacks

so that the response of each variety becomes different. Each variety has different genetic characteristics in responding to pathogenic infections so that the rate of development of emerging diseases is also different. reports that the severity of diseases due to [17] Curvularia lunata varies between rice varieties, indicating differences in genetic resistance to pathogens. In addition, studies have also shown that susceptible varieties experience higher rates of attack and yield loss than varieties that are more resistant to diseases caused by [18]

Overall, the results showed that there was a difference in the level of disease resistance between the corn varieties tested. In Diplodia disease, the ASA#3X, P32, NK Perkasa, Dahsyat, and WS407 varieties show a lower attack rate so that they can be categorized as more resistant than other varieties. Meanwhile, in Curvularia sp disease, the Bomber and NK Fantastic varieties show the lowest attack rate. These results show that the resistance of a variety to one type of disease is not necessarily the same to another. This difference is due to the resistance mechanisms of plants that are generally specific to specific pathogens. states that plant resistance genes often work specifically against specific pathogens or pathogenic breeds so their effectiveness can differ in different diseases so the selection of varieties needs to take into account the type of disease that is dominant at the cultivation site. [19]

Conclusion

The results showed that corn varieties had a significant effect on the rate of attack of *Diplodia* and *Curvularia* sp. There are differences in the rate of disease attack between varieties which shows variations in resistance to pathogenic infections. In *Diplodia* disease, the ASA#3X, P32, NK Perkasa, Dahsyat, and WS407 varieties show a lower attack rate so they are classified as more resistant than other varieties. Meanwhile, in *Curvularia* sp, the Bomber and NK Fantastic varieties showed the lowest attack rate. Differences in responses between varieties suggest that plant resistance is influenced by genetic factors and environmental conditions, and that resistance to one type of disease is not necessarily followed by resistance to another.

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