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SURVEY OF BACTERIAL BLIGHT OF SOYBEAN (*Glycine max L.*) CAUSED BY *Pseudomonas syringae* IN THE CENTRAL GEOPOLITICAL ZONE OF ADAMAWA STATE

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ABSTRACT

A survey was conducted in two Local government areas (Girie and Yola-south) of the central region of Adamawa state during the months of August and September, 2019. 16 soybean fields were surveyed (random sampling) for recording the severity and incidence of bacterial blight of soybean. At (P=0.05), In Girie local government area, result showed high percentage severity in GREF-5 and GREF-8 having the highest value (85%) respectively, the highest percentage disease incidence was recorded in GREF-5 (79.4%). Percentage disease incidence and severity in Yola-South was also high with YLSF-2 having the highest value (71.3%) and (85%) respectively. In the central geopolitical zone of Adamawa state, the Percentage incidence is moderate with mean value of (50.0%). Percentage severity is generally high in the zone with mean value of (65.6%). In conclusion, the research indicate a high percentage disease incidence and severity of bacterial blight of soybeans in the central geo-political zone of Adamawa state.

Keywords: Survey, bacterial blight, soybean, Pseudomonas syringae.

INTRODUCTION

Soybean (*Glycine max (L.) Merr.*) is an annual herbaceous legume plant of the pea family *Leguminosae* and subfamily *Papilionnidea* (Akinpelu and Onakoyo, 2006). According to Uwuoma, 2015. Soybean was first introduced to Nigeria in 1908. Attempts to grow the crop at Moor Plantation, Ibadan at that time failed. Later, introduction of the crop to the savanna ecology in 1928 proved successful. It then spread into other parts of northern Nigeria, and soon became a cash crop in the Tiv division of Benue Province (now Benue State), which thereafter became the leading production center (Uwuoma, 2015). The crop is now cultivated in most parts of north-eastern Nigeria, Adamawa State in particular (Adekunle *et al*. 2005).

Production of Soybean in Adamawa state is very low due to different types of the crop diseases. Different types of diseases of Soybean are caused by bacteria, fungi and viruses (Bailey and Bailey, 2006). Bacterial diseases of Soybean are most common in Adamawa. Bacterial blight disease accounts for 37-40% yield reduction in the study area (Wang *et al.,* 2007). *Pseudomonas syringae pv. glycine* is the causal agent of Bacterial blight of Soybean (Akinpelu and Onakoyo, 2006). *Pseudomonas syringae pv. glycine* is one of 50 pathovars belonging to the heterogeneous species *Pseudomonas syringae* (Al-Bari *et al*. 2006) . The symptoms of the disease include vein-limited, water-soaked lesions on the Soybean plant leaves, with or without a chlorotic halo, and water-soaked lesions on fruits, which may be misshapen (Bharathi *et al.* 2014). The spots first appear as water-soaked lesions on

leaves. The lesions usually expand until they are delimited by larger secondary veins. The aim of this research work is to conduct survey of *Pseudomonas syringae* responsible for the bacterial blight of soybean (*Glycine max L.*) in central geopolitical zone of Adamawa State.

MATERIALS AND METHODS

Study Area

The area has tropical climate marked by dry and rainy seasons, the rainy season commences around May and ends in the middle or late October while the dry season starts at October or November and lasts to April. The main annual rain falls ranges from 700 mm in the north western part to 1600 mm in the central geopolitical (Girie and Yola south local government area) part of the state. Maximum temperature is about 40^0C around April while minimum temperature could be as low as 18.3^0C between December and early January. Relative humidity in the area is about 26% in the month of January while February has the lowest value of 16%, the month of July and august usually have the peak with relative humidity of about 80%. Yola lies between latitude 7^0 and 11^0 north of the equator and between longitude 11^0 and 14^0 east of the Greenwich meridian Figure 1 and 2.

Sampling Techniques

For effective sampling, the study areas were coded and samples of soyabean plants Parts (leaves, stem or pod), the temperatures and amount of rainfalls which are representatives of the areas were collected as shown in the table below.

Random sampling method was employed and these samples were collected at designated areas as shown above. In each field percentage incidence and severity of bacterial blight of soyabeans were assessed by taken tape measurement of 4 x 4 square meters of four randomly selected locations on each farm not minding whether or not soyabeans was cultivated, inter-croped or grown as a sole crop. The four quaderants were spread in such a way that both center and edges of the farms was covered.

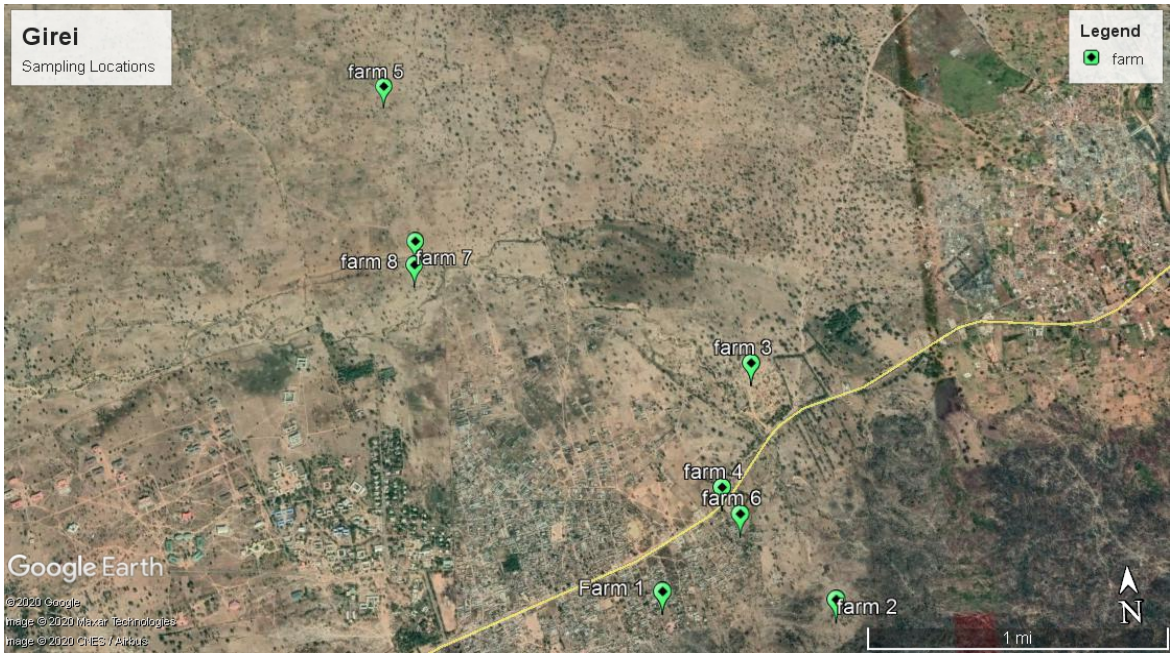

Figure 1: Google Map Showing Sampling Points in Girei Local Government Area

Figure 2: Google Map Showing Sampling Points in Yola-South Local Government Area

Table 1: Codes of Study Areas

S/N	Geo-political zones of Adamawa state	Local Government Areas of Adamawa state	Codes of sample locations	Co-ordinates	
1.	(i)Adamawa Central Zone (ACZ)	(a.) Girei	(GREF)	N	E
			GREF-1	09^0. 20. 565’	012. 31. 099’
			GREF-2	09^0. 20. 514’	012. 31. 615’
			GREF-3	09^0. 21. 244’	012. 31. 423’
			GREF-4	09^0. 20. 865’	012^0. 31. 302’
			GREF-5	09^0. 22. 224’	012^0. 30. 301’
			GREF-6	09^0. 20. 782’	012^0. 31. 351’
			GREF-7	09^0. 21. 696’	012^0. 30. 388’
			GREF-8	09^0. 21. 619’	012^0. 30. 383’
2.		(b.) Yola-South	(YLSF)		
			YLSF-1	09^0. 17. 475’	012^0. 25. 624’
			YLSF-2	09^0. 17. 961’	012^0. 24. 521’
			YLSF-3	09^0. 19. 539’	012^0. 23. 836’
			YLSF-4	09^0. 20. 187’	012^0. 23. 345’
			YLSF-5	09^0. 20. 327’	012^0. 23. 277’
			YLSF-6	09^0. 21. 129’	012^0. 22. 359’
			YLSF-7	09^0. 17. 975’	012^0. 23. 767’
			YLSF-8	09^0. 18. 349’	012^0. 24. 968’

The assessment of the disease percentage incidence was carried out by counting and recording the total number of soyabeans plants within a quadrant and the number of those amongst them that showed symptoms of bacterial blight disease. The formula is given by:

$$\%Disease\ incidence = \frac{Number\ of\ infected\ soybean\ plants}{Total\ number\ of\ soybean\ plants\ sampled}\ X\ 100$$

The severity of the disease on the infected plants was determined by using the visual scale of 0-5 in which:

0 = No visible sign of infection.
1= One or more spots on plants (1-10% stem, pod and leaf surface).
2= Some spots on several plants (11-30% stem, pod and leaf surface).
3= Some spots on several plants (31-50% stem, pod and leaf surface).
4= Many spots on all plants (51-80% stem, pod and leaf surface).
5= All plants with severity infections (81-100% stem, pod and leaf surface).

The values obtained from the visual scale were converted into percentage severity or severity index using the formular below:

$$\%Disease\ Severity = \frac{Sum\ of\ all\ disease\ ratings}{Total\ number\ of\ ratings\ X\ Maximum\ disease\ grade}\ X\ 100$$

Both the percentage disease incidence and severity on each soyabean farms were analyzed and compared. The data obtained from each farm were used to calculate and compare the averages for each local government area and subsequently averages of Local Government Areas were used to estimate that of the geo-political zone.

Experimental Design

The experiment was a completely randomized design (CRD) and data collected were in triplicates and analysed using statistical analysis system (SAS) version 23.

Data Analysis

All the data obtained were analyzed using analysis of variance (ANOVA) to test for significance using statistical tool for applied sciences (SAS) version 23 and the means that were significant were separated using the least significant difference (LSD) at 5% probability level (Schaffer *et al.,* 2010).

RESULTS

Analysis of variance showed significant difference of Result in Figure 3 at P=0.05 between percentage incidence and severity in Girie local government area of Adamawa state. However there are variations in significance difference among the eight farms sampled.

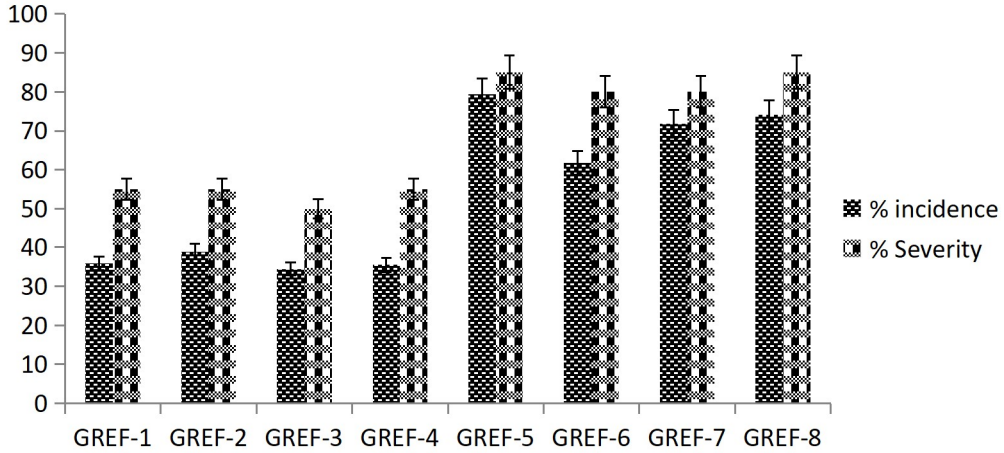

Figure 3: Percentage Incidence and Severity for Sampled Farms in Girei Local Government Area

There is no significance difference in percentage incidence between GREF-1, and GREF-2, GREF-3 and GREF-4, because the mean value from these farms is less than the least significance difference (LSD=15.1). There is however significance difference between GREF-1 and GREF-5, GREF-6, GREF-7 and GREF-8. There is no significance difference between GREF-2 and GREF-3 and GREF-4 however there is significance difference between GREF-2 and GREF-5, GREF-6, GREF-7 and GREF-8. There is no significance difference between GREF-3 and GREF-4 however there is significance difference between GREF-3 and GREF-5, GREF-6, GREF-7 and GREF-8. There is significance difference between GREF-4 and GREF-5, GREF-6, GREF-7 and GREF-8. There is also significance difference between GREF-5 and GREF-6, there is no significance difference between GREF-5 and GREF-7 and GREF-8. There is no significance difference between GREF-6 and GREF-7 and GREF-8.

The result also showed high percentage severity in Girei with GREF-5 and GREF-8 having the highest value (85). There is no significance difference in percentage severity between GREF-1, and GREF-2, GREF-3 and GREF-4, because the mean value from these farms is less than the least significance difference (LSD=15.3). There is however significance difference between GREF-1 and GREF-5, GREF-6, GREF-7 and GREF-8. There is no significance difference between GREF-2 and GREF-3 and GREF-4 however there is significance difference between GREF-2 and GREF-5, GREF-6, GREF-7 and GREF-8. There is no significance difference between GREF-3 and GREF-4 however there is significance difference between GREF-3 and GREF-5, GREF-6, GREF-7 and GREF-8. There is significance difference between GREF-4 and GREF-5, GREF-6, GREF-7 and GREF-8. There is no significance difference between GREF-5 and GREF-6, GREF-7 and GREF-8. There is no significance difference between GREF-6 and GREF-7 and GREF-8. There is no significance difference between GREF-7 and GREF-8.

Result in Figure 4 showed significant difference at P=0.05 from the Analysis of variance between percentage incidence and severity in Yola - South local government area of Adamawa state. There is however variations in significance difference among the eight farms sampled.

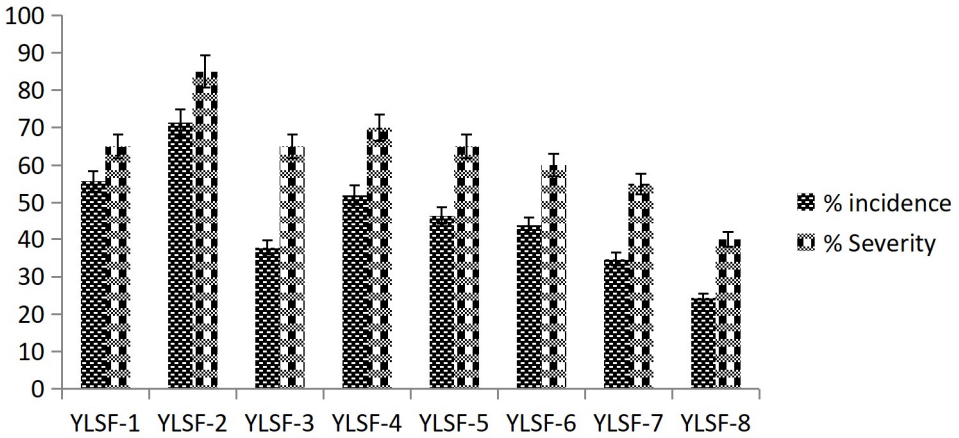

Figure 4: Percentage Incidence and Severity for Sampled Farms in Yola-South Local Government Area

There is significance difference in percentage incidence between YLSF-1 and YLSF-2, YLSF-3, YLSF-6, YLSF-7 and YLSF-8 because the mean value from these farms are greater than or equal to the least significance difference (LSD=11.5), but there is no significance difference between YLSF-1 and YLSF-4 and YLSF-5. There is significance difference between YLSF-2 and YLSF-3, YLSF-4, YLSF-5, YLSF-6, YLSF-7 and YLSF-8. There is significance difference between YLSF-3 and YLSF-4 and YLSF-8 But there is no significance difference between YLSF-3 and YLSF-5, YLSF-6 and YLSF-7. There is significant difference between YLSF-4 and YLSF-7 and YLSF-8, while there no significant difference between YLSF-4 and YLSF-5 and YLSF-6. There is significant difference between YLSF-5 and YLSF-7 and YLSF-8, while there is no significant difference between YLSF-5 and YLSF-6. There is significant difference between YLSF-6 and YLSF-8, while there is no significant difference between YLSF-6 and YLSF-7. There is also no significant difference between YLSF-7 and YLSF-8.

Percentage severity in Yola-South was also high with YLSF-2 having the highest value (85). At (LSD=15.6) there is significance difference in percentage severity between YLSF-1 and YLSF-2 and YLSF-8 but there is no significance difference between YLSF-1 and YLSF-3, YLSF-4, YLSF-5 YLSF-6 and YLSF-7. There is significance difference between YLSF-2 and YLSF-3, YLSF-5, YLSF-6, YLSF-7 and YLSF-8 while no significance difference between YLSF-2 and YLSF-4. There is significance difference between YLSF-3 and YLSF-8 But there is no significance difference between YLSF-3 and YLSF-4, YLSF-5, YLSF-6 and YLSF-7. There is significant difference between YLSF-4 and YLSF-7 and YLSF-8, while there is no significant difference between YLSF-4 and YLSF-5 and YLSF-6. There is significant difference between YLSF-5 and YLSF-8, while there is no significant difference between YLSF-5 and YLSF-7, YLSF-6. There is significant difference between YLSF-6 and YLSF-8, while there is no significant difference between YLSF-6 and YLSF-7. There is also no significant difference between YLSF-7 and YLSF-8.

The Result in figure 5 showed significant difference at (P=0.05) from the Analysis of variance conducted among the local government areas located in the ACZ. The result also showed there is no significant difference among the local government areas located in the central zone. Percentage incidence is moderate with mean value of (50.0%). There is significant difference in percentage severity in the central zone. Percentage severity is generally high in the zone with mean value of (65.6%). There is however variations in significance difference within the two local governments areas in each farms sampled in the zone. There is significant difference in Farm-1 between GRE and YLS. There is significance difference in farm-2 between GRE and YLS. There is significant difference in Farm-3 between GRE and YLS. There is significance difference in farm-4 between GRE and YLS. GRE and YLS all showed significant difference in farm-5. There is significant difference in Farm-6 between GRE and YLS. GRE and YLS showed significant difference in Farm-7. There is significant difference in Farm-8 between GRE and YLS.

DISCUSSIONS

A total of sixteen farms were randomly surveyed for Bacterial blight of soybean plants on the field from two local government areas in the central geo-political zone of Adamawa state. a similar survey was conducted by (Jagtap, Dhopte and Dey 2012) A survey was undertaken in eight districts (Parbhani, Nanded, Hingoli, Beed,

Osmanabad, Jalna, Latur and Aurangabad) of Marathwada region during June to August in Kharif, 2009 to 2010. In all, 69 soybean fields were surveyed (roving survey) for recording the severity and incidence of soybean blight.

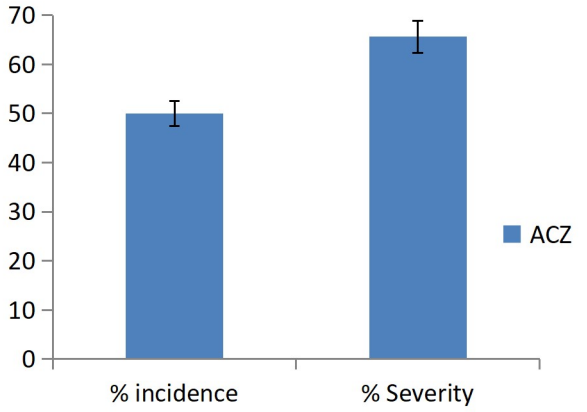

Figure 5: Percentage Incidence and Severity of the Central Geopolitical Zone of Adamawa State (ACZ)

Bacterial blight of soybean plants on the field surveyed showed symptoms such as water soaked yellow to brown spots on leaves, stems, petioles, and pods. These symtoms typically resembled those previously reported by Abrahamsen *et al*. 2011, Bacterial blight symptoms are particularly conspicuous on leaves and occasionally are found on stems, petioles, and pods. Water-soaked tissues often predispose plants to invasion by bacteria (Fairbairn *et al.,* 2007). Free moisture and moderate-to-warm temperatures are generally required for pathogen and disease development (Fragoso *et al.,* 2009). They are pathogenic primarily through the action of enzymes or toxins that produce chlorosis, water-soaking, and other symptoms (Grossi-De-Sa *et al.,* 2008).

There is generally high percentage incidence and severity in majority of the soybean farms surveyed in the two local government area, interpretation of the result of the central zone of Adamawa state also showed moderate percentage incidence and high percentage disease severity in the region. These findings were supported by the reports by (Jagtap, Dhopte and Dey 2012) Highest disease incidence and severity were noticed in Parbhani district followed by Hingoli, Nanded, Latur and Beed while lowest disease incidences were noticed in Jalna district.

CONCLUSION

After successful survey of eight farms from each of the two local government areas in the central geo-political zone of Adamawa state, the data that was obtained and interpreted showed that percentage incidence was moderately high in Yola-south, and percentage severity was generally high, the same also occurred in the second local government Girei with generally high percentage incidence and severity. Base on the scale of disease index rating from the two local government areas, it is safe to conclude that there is high percentage disease incidence and severity of bacterial blight of soybeans in the central geo-political zone of Adamawa state.

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