

Survey and Identification of Diseases on Major Crops of Assosa and Kamashi Zones, Ethiopia

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ABSTRACT

A survey was conducted in major crops of Assosa and Kamashi zones of Benishangul Gumuz Regional State during 2015 cropping season with an aim of identifying problematic diseases and providing baseline information on diseases of major crops in the study area. Disease assessments of major crops in both zones (except for Maize and Sorghum fields) were conducted by using 1m x 1m quadrat laid along diagonal of the fields. While, in Sorghum and Maize fields five plants per spot were randomly chosen along diagonal of the field for inspection. Moreover, plants with in the quadrants and/or the chosen plants per spots were thoroughly examined from base to the apex for diseases incidence and severity. A total of 63 farmers field were enclosed by this survey. It was founded that about 22 diseases of major crops of the study area were recorded from the field crops of the area. The result of this survey showed, major diseases of major field crops of Assosa and Kamashi zones in order of their importance were: 1) *Colletotrichum sublineolum* of Sorghum, 2) *Xanthomonas campestris* pv. *sesami* of Sesame, 3) *Mycosphaerella graminicola* of Soybean, 4) Brown spot of Finger millet, 5) *Exserohilum turcicum* of Maize, 6) Maize Streak Virus of Maize, 7) *Cercospora sorghi* of Sorghum, 8) *Magnaporthe grisea* of Finger millet and 9) Fusarium wilt of Hot pepper; respectively each with a magnitude of percentage disease severity index of 46.3, 42.58, 38.27, 38.10, 37.78, 37.33, 35.53, 34.13 and 31.48. Therefore, any intervention including direct research toward creating new or adopting an integrated disease management options must focus on those prioritized major diseases of the area; to have higher, good and quality agricultural produces. In addition, regular disease survey and/or surveillance must be conducted to identify

possible challenging diseases of major field crops in the study area.

Keywords: Diseases, major crops, disease severity, disease incidence and disease severity index.

INTRODUCTION

One of the most common problems encountered by farmers throughout the world is a control of pests that interfaces with agricultural production. It causes a serious damage to crops by effectively competing with the beneficial and desired crop, damaging plant and plant parts and by other chemical effects. In addition, the pest increases labor that adds to the cost of production, and reduces yields of crops.

In case of Benishangul Gumuz Regional State, agriculture accounts for 93.2% of the regional economy [3] and also the region was one of the potential regions of the country endowed with fertile land and ample rainfall, which are suitable for agricultural production. [2] The major crops grown in the region including currently emerging crops are: sorghum, maize, finger millet, sesame, Niger seed, groundnut, soybean, hot pepper, and mango. [1,5] Even though the region is suitable, but there were so many obstacles for the agricultural sector of the region. Among them, crop diseases and pests are serious problems that contributed to low crop productivity. [2] For instance, Dutch Interchurch Aid [4] reported that in Assosa district pests caused a total of annual crop loss was estimated to 30-40%. Yet, there was no research based information on the lists of constraining diseases pests of major crops of Assosa and

Kamashi zones of Benishangul Gumuz region. Taking this in to consideration, the crop protection team of AsARC was initiated this survey study with the aim of identifying problematic diseases and providing baseline information on the diseases of major crops in the study area. Furthermore, it was also aimed to make the information available for any individuals or an organization who was interested for diseases of major crops in Assosa and Kamashi zones of Benishangul Gumuz region for further works.

MATERIALS AND METHODS

The survey was conducted at Assosa zone (in Assosa, Bambasi, and Homosha districts or 'Woredas') and Kamashi zone (in Kamashi district) of Benishangul Gumuz region. In each district crops of major importance were selected and attention was given to those selected crops of the area at the time of implementing the survey. This survey was assessed thoroughly in a total of 63 farmer fields in 2015 main cropping season. Within selected fields a quadrant of 1m x 1m was thrown and disease incidence and severity were taken for every quadrant by crossing the fields diagonally. All plants within the quadrant were thoroughly observed starting from the ground up to the tip shoots of the crop and the severity of existing diseases was rated by using 1-9 disease scoring scales. Besides, for fields that were not easy to use 1m * 1m quadrants (e.g., in Maize and Sorghum fields), five plants per spot were taken and disease assessment was made on them by following the same procedures as the previous one. Also, altitude and GPS coordinates of each crop field were collected. Moreover, disease incidence and severity was calculated by using the following equations (eqn. 1 to 3):

$$\text{Disease incidence (DI)} = \frac{\text{Number of infected plant units}}{\text{Total number of units assessed}} \times 100 \dots \dots \dots (1)$$

$$\text{Disease Severity (DS)} = \frac{\text{Area of plant tissue affected by disease}}{\text{Total area}} \times 100 \dots \dots \dots (2)$$

$$\text{Disease Severity Index (DSI)} = \frac{\sum ab}{NK} \times 100 \dots \dots \dots (3)$$

Where; is number of assessed plants, b is severity scale scored, N is total number of assessed plants, and K is the highest severity score scale.

RESULTS AND DISCUSSIONS

The major field crops of Assosa zone were Sorghum, Maize, Soybean, Niger seed, Finger millet, Ground nut and Hot pepper, while that of Kamashi zone were also Sorghum, Maize and Sesame. Therefore, this survey was focused on these major crops of the study area. The result of this assessment founded that, twenty two diseases were recorded on major crops of Assosa and Kamashi zones of Benishangul Gumuz region (see table 1). Among them, *E. turcicum* (Leaf blight), Maize Streak Virus, *C. sorghi* (Grey leaf spot) and Maize Stripe Virus diseases of maize crops, *Cercospora* leaf spot disease of Niger seed, Hot pepper and Sesame, and *X. campestris pv. sesami* (Bacterial blight) disease of Sesame were found in all assessed fields of the study area with a disease incidence of 100 percent. Next to these, the highest disease incidence (90%) was recorded by *C. personatum* (Late leaf spot) disease of Groundnut. On the other side, the lowest disease severity was recorded on sorghum diseases namely, *S. sorghi* (Covered kernel smut) and *R. sorghicola* (Oval leaf spot) respectively, with 6.25 and 18.75 percent of incidence (table 1).

Moreover as illustrated in table 2, the most important major field crop diseases of Assosa and Kamashi zones that need management intervention in their descending order were *C. sublineolum* (Anthracnose) of Sorghum, *X. campestris pv. sesami* (Bacterial blight) of Sesame, *M. graminicola* (Leaf blotch) of Soybean, Brown spot of Finger millet, *E. turcicum* (Leaf blight) of Maize, Maize streak virus of Maize, *C. sorghi* (Grey leaf spot) of Sorghum, *M. grisea* (Blast) of Finger millet and Fusarium wilt of Hot pepper. The

disease severity indexes of the most important diseases of major crops of the study area was respectively, 46.30%, 42.58%, 38.27%, 38.10%, 37.78%, 37.33%, 35.53%, 34.13%, and 31.48%.

Sorghum Diseases of Assosa and Kamashi Zones

Among the five diseases recorded on sorghum crops (as shown in table 2), the incidence of *C. sublineolum* in Assosa and Bambasi districts of Assosa zone were 100%, while in Kamashi district of Kamashi zone the incidence was 75%. Also, *C. sublineolum* was 50% incidence in Homosha district of Assosa zone. These implies, *C. sublineolum* of sorghum diseases

was geographically distributed in all sorghum growing areas of Assosa, and Bambasi districts. However, in Kamashi and Homosha districts *C. sublineolum* was covered 75% and 50% of sorghum growing areas, respectively. On the other hand, *C. sublineolum* was commonly observed in sorghum fields of Assosa and Bambasi districts, i.e. it was a major disease of sorghum in these areas. In the same way, the highest severity (5 and 5.14) of *C. sublineolum* was recorded on sorghum fields of Assosa and Bambasi districts. In the case of Homosha and Kamashi, the severity of *C. sublineolum* was 3 and 2.5, respectively; which opposes the incidence.

Table 1: Incidence and severity of diseases attacked major crops of Assosa and Kamashi zones

Major crops	Elevations (m.a.s.l)	Diseases of major crops	Status of diseases		
			DI (%)	DS	DSI (%)
Sorghum	1205 - 1536	Anthracnose (<i>Colletotrichum sublineolum</i>)	87.5	4.17	46.30
		Grey leaf spot (<i>Cercospora sorghi</i>)	87.5	3.2	35.53
		Oval leaf spot (<i>Ramulispora sorghicola</i>)	18.75	1.31	14.58
		Leaf blight (<i>Exserohilum turcicum</i>)	37.5	1.58	17.59
		Covered kernel smut (<i>Sphacelotheca sorghi</i>)	6.25	1.13	12.5
Maize	1385 - 1519	Leaf blight (<i>Exserohilum turcicum</i>)	100	3.4	37.78
		Maize Streak Virus (MSV)	100	3.36	37.33
		Grey leaf spot (<i>Cercospora sorghi</i>)	100	2.56	28.44
		Maize Stripe Virus	100	2.46	27.33
Soybean	1394 - 1519	Brown spot (<i>Septoria glycines</i>)	77.78	2.26	25.06
		Leaf blotch (<i>Mycosphaerella graminicola</i>)	88.89	3.44	38.27
		Sudden death (<i>Fusarium solani f.sp. glycines</i>)	11.11	1.11	12.35
Finger millet	1400 - 1543	Blast (<i>Magnaporthe grisea</i>)	85.71	3	34.13
		Brown spot	85.71	3.5	38.10
Niger seed	1392 - 1544	Cercospora leaf spot	100	2.2	20
		blight	60	2	20
Groundnut	1230 - 1543	Early leaf spot (<i>Cercospora arachidicola</i>)	80	0.6	11.9
		Late leaf spot (<i>Cercospora personatum</i>)	90	1.01	20.2
		Alternaria leaf spot (<i>Alternaria arachidis</i>)	30	0.14	2.78
Sesame	1231 - 1523	Cercospora Leaf spot	100	2.67	29.64
		Bacterial blight (<i>Xanthomonas campestris pv. sesami</i>)	100	3.83	42.58
Hot pepper	1401 - 1512	Cercospora Leaf spot	100	2.71	27.31
		Fusarium wilt	50	2.5	31.48
		Pod wilt	83.33	2.25	27.78

Key: DI=Disease Severity, DS=Average Disease Severity, and DSI=Disease Severity Index

Table 2: Top 9 important diseases of major crops in Assosa and Kamashi zones

No.	Most important diseases of Major crops	DSI (%)	Priority rank
1	<i>Colletotrichum sublineolum</i> (Anthracnose) of Sorghum	46.30	1
2	<i>Xanthomonas campestris pv. sesami</i> (Bacterial blight) of Sesame	42.58	2
3	<i>Mycosphaerella graminicola</i> (Leaf blotch) of Soybean	38.27	3
4	<i>Brown spot</i> of Finger millet	38.10	4
5	<i>Exserohilum turcicum</i> (Leaf blight) of Maize	37.78	5
6	<i>Maize streak virus</i> of Maize	37.33	6
7	<i>Cercospora sorghi</i> (Grey leaf spot) of Sorghum	35.53	7
8	<i>Magnaporthe grisea</i> (Blast) of Finger millet	34.13	8
9	<i>Fusarium wilt</i> of Hot pepper	31.48	9

Key: DSI= Diseases Severity Index

Furthermore, the second important disease of Sorghum was *C. sorghi* (Grey leaf spot); which had an incidence of 100 %, 100%, 80% and 50% respectively, at

Kamashi, Bambasi, Assosa and Homosha districts with average severity of 3.58, 3.07, 3.4, and 2.25. However, the minor diseases of sorghum in both zones were *E. turcicum*

(Leaf blight), *Ramulispora sorghicola* (Oval smut).
Leaf spot) and *S. sorghi* (Covered kernel

Table 3: Incidence and severity of diseases that attacked major crops in both zones by districts

Major crops	Diseases of major crops	Scores of diseases on major crops of the study area							
		Assosa		Homosha		Bambasi		Kamashi	
		DI (%)	DS	DI (%)	DS	DI (%)	DS	DI (%)	DS
Sorghum	<i>Colletotrichum sublineolum</i>	100	5	50	3	100	5.14	75	2.5
	<i>Cercospora sorghi</i>	80	3.4	50	2.25	100	3.07	100	3.58
	<i>Ramulispora sorghicola</i>	40	1.7	-	-	20	1.3	-	-
	<i>Exserohilum turcicum</i>	40	1.8	50	1.5	20	1.2	50	1.83
	<i>Sphacelotheca sorghi</i>	-	-	-	-	-	-	25	1.5
Maize	<i>Exserohilum turcicum</i>	100	3.67	-	-	100	3	-	-
	Streak virus	100	3.6	-	-	100	3	-	-
	<i>Cercospora sorghi</i>	100	2.93	-	-	100	2	-	-
	Stripe virus	100	2.6	-	-	100	2.25	-	-
Soybean	<i>Septoria glycines</i>	75	2.25	-	-	80	2.26	-	-
	<i>Mycosphaerella graminicola</i>	75	2.5	-	-	100	4.2	-	-
	<i>Fusarium solani f.sp. glycines</i>	25	1.25	-	-	*	*	-	-
Finger millet	<i>Magnaporthe grisea</i>	100	3.63	-	-	66.67	2.17	-	-
	brown spot	100	4.25	-	-	66.67	2.5	-	-
Niger seed	<i>Cercospora</i>	100	2.33	-	-	100	2	-	-
	Blight	66.67	2.33	-	-	50	1.5	-	-
Ground nut	<i>Cercospora arachidicola</i>	100	0.87	100	0.33	50	0.39	50	0.25
	<i>Cercospora personatum</i>	100	1.34	-	-	100	0.78	100	0.92
	<i>Alternaria arachidis</i>	40	0.23	-	-	50	0.11	-	-
Sesame	<i>Cercospora</i> Leaf spot	100	2.34	-	-	-	-	100	3.5
	<i>Xanthomonas campestris pv. sesami</i>	100	3.67	-	-	-	-	100	5
Hot pepper	<i>Cercospora</i> Leaf spot	100	2.69	-	-	100	2.75	-	-
	Fusarium wilt	50	2.36	-	-	50	2.75	-	-
	Pod wilt	83.33	2.5	-	-	50	1.75	-	-

NB: For disease severity rating in groundnut 0 - 5 scales was used

Maize Diseases of Assosa and Kamashi Zones

A total of four diseases were founded from maize crop of the study area. All of them were recorded 100% incidence with varied average severity scores; in between 2.6 to 3.67 and 2.0 to 3.0 at Assosa and Bambasi districts of Assosa zone, respectively. In the case of Homosha and Kamashi districts, there was no disease data obtained on maize crop at the time of survey implementation. Furthermore, maize leaf blight and maize streak virus diseases were the most important diseases of Maize crop of Assosa and Bambasi districts or 'Woredas' (see table 2).

Soybean, Niger seed, Ground nut and Sesame Diseases of Assosa and Kamashi Zones

Sesame, Soybean, Niger seed and Ground nut were the four important oil crops of the region in order of their importance. By this survey, two diseases were identified from sesame crops, three diseases from soybean crops, two diseases

from Niger seed and three diseases from Ground nut crops of the study area (table 1).

Among the three diseases of soybean, Leaf blotch was the most important disease of Soybean with an incidence of 100% and 75% and an average severity score of 4.2 and 2.5 at Bambasi and Assosa districts of Assosa zone, respectively. Next to leaf blotch, Brown spot of Soybean was also an important disease which had incidence and severity of 80 and 75 percent, and 2.25 and 2.26 severity scores in Bambasi and Assosa, respectively.

Cercospora leaf spot was a common disease of Niger seed and Sesame and it had an incidence of 100% at Assosa and Bambasi on Niger seed crops. Also, on Sesame crops *Cercospora* leaf spot had the same incidence at Assosa and Kamashi districts. However, on both crops (Sesame and Niger seed) the disease had almost the same severity at Assosa and Bambasi, but the severity was somewhat higher in the case of Kamashi on Sesame crop. Besides, Sesame was also affected by a most

important disease called bacterial blight of sesame with an incidence of 100% and average severity score of 3.67 and 3.5 at Assosa and Kamashi, respectively.

Finger millet and Hot Pepper Diseases of Assosa and Kamashi Zones

Hot pepper is one of the cash crops of the study area, but now a day's its production was challenged by *Fusarium* wilt and pod wilt diseases. Because, the farmers of Assosa and Bambasi districts were not familiar with the management options of the two diseases. However, some farmers tried to uprooted diseased plants to minimize the disease severity without other supportive control measures, but they were not effective doing so. In contrast, some farmers were hesitated to uproot the diseased hot pepper plants and they considered it as "a wrath of God". These all implies, there was no control options recommended to the localities. This therefore, urges for the need of management option recommendations for wilt diseases of hot pepper in the study area.

CONCLUSIONS AND RECOMMENDATION

Major crops of the study area in their dominance order were Sorghum, Maize, Sesame, Soybean, Niger seed, Finger millet, Hot pepper and Ground nut. From these field crops, twenty-two diseases were recorded by this study in both zones of the region (table 1). Among them, the major field crop diseases of the area were *E. turcicum* (of maize), *C. sorghi* (of maize and sorghum), *X. campestris pv. sesami* (of sesame), *C. sublineolum* (of Sorghum), *C. personatum* (of groundnut), *Streak and Stripe Virus diseases* (of maize), and *Cercospora leaf spot* (of sesame). In contrast, minor diseases of the study area were *Sphacelotheca sorghi* (of Sorghum), *Ramulispora sorghicola* (of Sorghum),

Fusarium solani f.sp. glycines (of soybean), and *Alternaria arachidis* (of groundnut).

Thus, we suggested an intervention including direct research toward creating new or adopting an integrated disease management options on those prioritized major diseases of the area; to have higher, good and quality agricultural produces. Also, we forwarded a regular disease survey and/or surveillance to identify possible challenging diseases of major field crops in Assosa and Kamashi zones.

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