

# Assessments of Major Cereal Disease in Potential Agro-Ecology of Borana Zone , Southern Oromia

Tolessa Taye Natol Bekele Yonas Shimalis Addis Shiferaw  
Oromia Agricultural Research Institute Yabello Centre, P.O.Box 85, Yabello, Ethiopia

## Abstract

Cereal Production in Borana lowland and Mid highland were threatened by a number of biotic and abiotic factors. Among these biotic factors diseases were the prominent one. Therefore, these survey work was conducted in Borana administrative zone , to determine the incidence and severity of major cereal disease and to identify areas of intervention for optimization of cereal productivity. Eighteen site, which represent the two agro-ecological zones were surveyed. Six representative crop producing districts of the zone were selected based on the agro-ecology of the zone. From this six districts 18 PAs were purposively selected. From one district three PAs were assessed from each PA 10 fields were surveyed at an interval of 5-10 km . The main cereals grown in these areas were maize , Tef wheat barley and sorghum. From these major cereal crop most frequently six different types of disease were identified these diseases were GLS, Rusts, Fusarium head scab of wheat Loose smut, Northern maize blight (Turcicum leaf blight) and Maize ear rots. In all the surveyed area all these disease were prevalent, However, the extent of the economic damage varies depending on factors such as production systems, climate, choice of variety. Disease problem is less feared in miyo and Yabello as compared to fear of the rainfall shortage. At Teltale loose smut disease of sorghum, tef and barley were significantly important . While the incidence and disease severity is less than 20 % in lowland (rainfall deficit areas) except loose smut at Teltale. While disease are the most economically important in all the rests of the districts. Therefore these survey results open the doors for the estimation of economic loss caused by these identified disease on the major cereal at Abaya, Galana and Bule hora. In Mid highland areas of the zone foliar disease like turcicum leaf blight, leaf rust and grey leaf spots are among the challenging disease of maize, in addition to this crop wheat is one of the important cereal crops of mid highland which were highly affected by rust and Fusarium head scab disease. However, in 2014 no disease was assessed from lowland due to the failurity of the crop before reaching the flowering stages.

**Keywords:** Cereal disease

## INTRODUCTION

Borana lowland and mid highland are currently becoming as one of the option sought for crop production as an income source and employment opportunity for many people of the areas as their livelihood improvement , in spite of these crop production is highly affected by many abiotic and biotic factor that limit potential of the crops. Farmers/Agro-pastoralist in this area use different cereal crops in small scale or large scale production for the sake of different purpose 1) to reduce the failures that bound crop production from rainfall uncertainty and (2) to increase food diversification. Generally, the crop production system of Borana lowland and mid highland were highly vulnerable to main crop disease like Rust disease, Northern Corn Blight, Loose smut and Fusarium head scab. Because in these area planting is done two times in a year this create conducive environment for the pathogen to evolve and increase inoculum load of the area which cause serious yield loss on susceptible cultivars.

Disease is more problematic in districts like Bule hore, Abaya and Galana compared to Yabello, Miyo and Teltale. In Yabello and Miyo the effect of moisture stress is more visible than any other biotic factors. However, some disease like smut is very important in a district like Teltale, the damage incurred by this fungi approximately near to 50% and the most devastating disease because it is difficult to manage at field conditions because disease appeared immediately after the crop start to heading. No seed treatment is used by the farmer and farmer purchase the seeding material from the local market of the area that have no farm background information. That why it is difficult to take controlling measures easily . Loose Smut is important mainly on sorghum, maize, Tef, barley and rarely found on wheat.

The other diseases which found on maize are moniliform (Maize ear rot) Bacterial blight ( Northern maize leaf blight), Maize leaf rust (Puccini sorgi ) and MLN suspecting in some of the surveyed area. The degree of disease severity is vary from very low (0%) to very high in the three districts( Bule hora, Galana and Abaya). Currently, crop yield losses due to the identified disease need to be quantified with independent study so as to ascertain the magnitude of the problem in these areas. Therefore, this survey work will be enable the researcher to give research priority to the most frequently occurring crop disease of the area to design most effective management strategy in the future.

According to Gildemacher, *et al.*, (2009), for instance, for effective targeting of research and development efforts, a more detailed country or region specific analysis of the crop production system and its potential opportunities and possible constraints is required. The survey not only helps to identify relevant areas of intervention, but also helps to identify weaknesses within the system that need to be revised immediately.

However, no survey study was conducted in Borana with respect to cereal potato production system practices.

### **Objective**

- To determine the incidence and severity of major cereal disease in potential agro-ecology of Borana Zone

### **MATERIALS AND METHODS**

A disease survey was conducted in six major cereal growing districts of Borana zone to assess major cereal disease during the main cropping seasons of 2013 and 2014. The three districts had an altitude range (1200-1500 m.a.s.l) which is categorized under lowland and the three districts had an altitude range of (1500-2300 m.a.s.l) these categorized under mid highland agro-ecologies. The site selections for the surveyed areas were carried out in collaboration with experts from respective districts bureaus of agriculture. A total of 6 districts /woreda from each districts 3 PAs were assessed. From each PA 10 sampling fields were evaluated / assessed. The Districts were purposively selected while PAs were randomly selected from the already selected districts and based on the potential of cereal crop production of the districts. The disease assessment was made at nearest to flowering growth stage. During 2014 cropping seasons the disease was not assessed from Miyo and yabello due to the extreme rainfall shortage occurred in this area throughout the growing season. Disease assessment was made along the two diagonals (in an "X" pattern) of the field from three points using 0.5mX 0.5m (0.25m<sup>2</sup>) quadrants. From the six districts 18 Peasant association and 180 farms were selected. From one peasant association 10 cereal fields were assessed at an interval of 5-10 km distance based on the field availability. Farmers were interview for (planting time, fertilizer use, crop rotation if they use and time of disease onset if disease is appeared).

### **SURVEY RESULTS**

A total of 18 sites or PA were visited, ranging from 1,300 meters above sea level (masl) to 2270 meters above sea level representing two different agro-ecology of the zones. The present survey results reveals that Maize, Tef, Wheat, barley and sorghum were among the major cereals crops widely grown and many pathogens or disease causing organisms were feeds on these crops found to be important to reduce the biomass yield and quality in our study areas, which is in agreement with Riana and Himantharaj (2004) finding. All the crops were cultivated two time in a year except for maize and sorghum. A total of 6 different major cereal diseases were identified in the surveyed area with various degree of disease incidence and severity (Table 4,5 and 6). In Yabello and Miyo districts no disease data were collected during 2014 cropping season because of the whole crops were failed due to the extreme rainfall shortage that happened throughout the lowland of Borana except at Teltale. At this districts Loose smut of sorghum was serious disease of the area as interviewed farmers replied and field observation during the survey work.

The result of this survey work reveals that 6 major cereal diseases (Table 4, 5 and 6) were identified from Maize, Tef, Wheat, Barley and Sorghum. The main economic importance of these disease was not clearly studied except for disease like smut disease of sorghum, barley and Tef. Therefore, these survey work will open the door for yield loss assessment or the economic losses caused by these major disease identified in the area ( GLS, common rust, Northern maize blight, Loose smut, Fusarium moniliform and Fusarium head scab). However, the extent of the economic damage varies depending on factors such as production systems, climate, choice of variety .The major disease identified from wheat crop: Leaf rust, Wheat stem rust and Fusarium head scabs were among the most challenging disease in the three districts ( Abaya, Galana and Bule hora) ranging from low disease severity to high level of disease severity. Some fields shows good field resistance and while 90% of fields shows intermediate disease severity to completely damaged by these major disease identified in Abaya, Galana and Bule hora. Specifically by wheat stem rusts in the three districts. It is worth mentioning that the result of these survey work reveled that disease prevalence was 100% on maize and wheat in the three districts of the zone(Table 4,5 and 6). Wheat Rust disease and Fusarium head scab of wheat was extremely important disease because in all of the districts planting was done two times in a year and this creates an opportunity for the continuous supply of the pathogen without few or no break. These notify disease pressure was high. This ascribed that the environmental condition of the area is conducive for the disease development ( Moisture, warmer and susceptible host) in these three districts. In Bule hora last year cropping season maize was highly devastated early before maturity and we suspect the entrance of MLN disease in Borana zone during the main season of 2013. During this year we also lost research trial at Bule hora district. And we reported as a premature drying of maize and which cause 100% weight loss was reported from all farmer of the area). Currently, the production of maize and wheat is hardly decreased from the previously cultivated area due to different disease problem happening the year round.

**Table 1. Major cereal crops and disease report in the major cereal growing areas of the zone**

District name	Major crop according to area coverage	Major disease assessed	Remark
Yabello	Tef, Maize, wheat, barley and sorghum	Loose smut on sorghum, barley and tef	Except maize and sorghum all are cultivated two time a year
Taltale	Tef, maize, Sorghum, wheat, barley	Loose smut on sorghum, barley tef	
Miyo	Tef, Maize and barley	Loose smut on barley	
Abaya	Maize, wheat, tef barley and sorghum	GLs, N. Maize blight, Erot, C. rust, Stem rust, leaf Rust. Loose smut of barley and tef	
Galana	Maize, Wheat, Barley and wheat	GLs, N.Maize blight, Erot, C. rust, Stem rust, leaf Rust. Loose smut of barley and tef	
Bule Hora	Wheat, maize and Barley	Stem rust, Fusarium head scabs, Leaf rust, yellow rust, GLS, N. Maize blight, Maize ear rot.	Except maize all are cultivated two time a year

**Table2. Number of farm assessed 2013, number of infected and free fields of three**

Name of districts	Name of peasant associations	# of field assessed	#of infected fields	# free fields
Yabello	Colkassa	10	3	7
	Derto	10	4	6
	Did yabello	9	7	2
Miyo	Gomo goda lon	9	1	8
	Mexi	8	6	2
	Tesso	10	6	4
Teltale	Kalo	9	4	5
	Ebsa	8	2	6
	Bule Korma	10	8	2
Abaya	Samaro	10	9	1
	Guangua	10	6	4
	Ture Kajima	10	8	2
Galana	Tore Badiya	10	10	-
	Samalo	10	7	3
	Kersa	10	8	2
Bule hora	Hera liphitu	10	10	10
	Muri Turkuma	10	10	10
	Garba	10	10	10

**Table3. Number of farms assessed in 2014, number of infected and free fields from three Mid highland area of Borana Zone**

Name of Districts	Name of peasant Associations	# of field assessed	# of field infected	# of free fields
Abaya	Samarro	10	10	0
	Biyo	9	9	0
	Ture kajima	10	10	
Galana	Cekkata	10	9	1
	Samallo	10	8	2
	Kersa	10	10	0
Bule hora	Hera liphitu	10	10	0
	Dugo Bulcha	10	10	0
	Mata koma	10	10	0

The disease incidence and severities was vary from district to district and from year to year ranging from zero to 100%( Table 4,5 and 6). This variation can be associated with the types of variety used and farming practices on the top of others. In majority of assessed area farmers used land races ( particularly for maize during the main growing season) which take longer time to mature (it take 6 to 8 month). That why the crop is exposed to pathogen for a long period of time and this will create opportunity to cause a significant decrease of yield. The same is true for others because the others crops are planted to times a year through out zone. However, in lowland the fear of disease problem is comparable less compared to the fear of rainfall shortage except in few cases. In Teltale where major production types were Tef, Maize and Sorghum the problem of loose smut disease were very high and most abundant and more severe disease compared to other cereal disease. In all the low land where disease assessment made the severity was less than 20% except for loose smut in Teltale in these area the disease severity was recorded up to 50% which was equivalent to disease incidence. In Borana lowland during the two consecutive years the problem of disease is not important but in the future we are not sure it may appeared in any time if the condition permit for the occurrence in yabello and miyo districts however, during these survey work the disease problem is only important in ( Abaya, Galana and Bule hora).this means the prevalence of the disease incidence and severity was more dominant here particularly for rust disease of wheat, GIS, Common rust, N. maize blight and loose smut disease of different cereals. In these districts the chance of getting disease free farm is very rare. All major six (6) identified were prevalent in these mid highland area of the zone.

**Table 4: Disease incidence and severity of three districts of Borana lowland**

District	PA	Common Rust( <i>Puccinia sorghi</i> )		Maize/Sorghum Blight		Covered Smut	
		Incidence	Severity	Incidence	Severity	Incidence	Severity
Yabello	Colkassa	50(1)	T	50	20	-	-
	Derto	10(3)	T	20	5		
	Did Yabello	50 (1)	T	30	10	10	10
Miyo	Gomo goda lon	-	-	-	-	20(1)	20
	Tesso	30(2)	T	100(3)	10	25(1)	25
	Mexi	10(2)	T	50(3)	10	5(1)	5
Teltale	Kalo	-	-	50(7)	5	20(4)	20
	Bule Korma	-	-	40(4)	10	50(4)	50
	Ebsa	-	-	-	-	50(2)	50

Numbers in parenthesis indicating number of fields infecting by the same disease in the same peasant associations.

**Table 5: Disease incidence and severity major disease by districts base**

Dist	PA	GIS		Rust		F. Head scab		Ear rot		Loose smut		N.M. blight	
		Inci	Sev	Inci	Sev	Inci	Sev	inc	Sev	Inci	Sev	inci	Sev
Abaya	Samaro	100(2)	20	100(1)CR	T	-	-	10	100	40(3)	40	100(4)	20
	Biyo	100(4)	20	100(2) CR	10	0	0	0	0	20(2)	20	100(1)	10
	Ture Kajima	100(1)	20	100(3) CR	10	0	0	20	100	80(5)	80	100(2)	20
Galana	Cekketa	-	-	100(5)SR	50	30(3)	60	30	100	10(1)	10	-	-
	Kersa	100(2)	30	100(3)CR	20	0	0	10	100	50(5)	500	-	-
	Samallo	100(1)	10	-	-	20(2)	50	0	0	30(4)	30	100(3)	30
Bule Hora	Hera Liphitu	100(3)	20	100(4)	80	10(1)	50	20	100	20(1)	20	100(3)	30
	Dugo Bulcha	100(2)	20	100(4)SM,LR, YR	100	40(3)	60	10	100	0	0	100(3)	50
	Mata koma	0	0	100(10)	80	60(5)	80	0	0	0	0	0	0

**Table 6: Incidence and Severity of on Major Cereal Disease Based on District**

District	GLS		Rust		Loose Smut		N. Maize blight		F.Head Scabs		Erot	
	Inci	Sev	Inc	Sev	Inc	Sev	Inc	Sev	Inc	Sev	Inc	Sev
Yabello	-	-	-	-	-	-	-	-	-	-	-	-
Miyo	-	-	-	-	-	-	-	-	-	-	-	-
Taltale			20	T (LR)	50	50	-	-	-	-	-	-
Galana	100	50	100	TCR, 80SR, 20LR	50	50 (tef)	100	20	20	T	10	80
Abaya	100	20	100	10Cr,100	50	50 (tef and barley)	100	30	30	50	-	-
Bule hora	100	10	100	20CR,80SR,10LR	-	-	80	40	40	60	30	100

where these are symbol used to represent CR= common Rust of maize, LR= leaf Rust of wheat and tef rust , SR= Stem Rust, C.Smut = covered smut, Fwt= Fusarium Head scab

## CONCLUSION

The present study provided some clues to the understanding of the disease incidence and severity the economically important disease in Borana zone. From this study it can be concluded that the major cereal were grey Leaf spot, Rust ( Stem rust, Leaf rust and Common Rust), Northern Maize blight( Turcicum maize blight) ,Ear Rot (Fusarium moniliform) and Loose smut. Severity of wheat stem rust was recorded and found to vary from low to high at different districts and PA levels (Table 5 and 6). The highest average disease severity of 100% was recorded in Galana, and Bule hora , followed by Abaya district (Table 5 and 6). These makes the importance of disease vary from districts to districts as well as season to season on major cereal crops grown in wider areas of the zone. The disease incidence and severity as well as types of disease were shows great variation from lowland to mid highland. The lowest severity both at district and peasant association level was recorded in miyo and yabello districts respectively. Almost all (90%) of the surveyed area replied that no one follow appropriate cultural practices these might be may a cause for the aggravation of the problem in mid highland of the zone. In Borana zone as a whole no planned crop rotation and farmer still rely on local cultivars and short duration of the offseason. In all the area the duration of closed season is very small. That means crops are grown throughout the season and these create continuous supply of pathogen.

## RECOMMENDATION

It requires more attention towards the use of improved varieties or genetically in built crops so that crops by itself can overcome yield decrease caused by the major cereal disease identified in the zone. It is important for all stake holder to create awareness for the farmers about the use of appropriate agriculture practices that create conducive condition for crops so that the crops can develop the first defensive mechanism at field condition. And these survey is calling for screening for disease resistance in the hot spot area of

## Future Research direction

1. Plan for resistance breeding in three major cereal producing districts
2. Conduct yield loose analysis for maize foliar disease
3. Create awareness of farmer on improved technology
4. Provide continuous training on the major cereal disease

## Reference

- Gildemacher P.R., Kaguongo W., Ortiz O., Tesfaye A., Woldegiorgis G., Wagoire W.W., Kakuhenzire R., Kinyae P.M., Nyongesa M., Struik P.C. and Leeuwis C. 2009. Improving Potato Production in Kenya, Uganda and Ethiopia: A System Diagnosis. Potato Research. 52: 173- 205.
- Riana, R.K.,and Himamntharaj,M.T.2004 Silkworm Rearing Tschology, Central Silk Board , Bangalore 163pp.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:

<http://www.iiste.org>

### CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

**Prospective authors of journals can find the submission instruction on the following page:** <http://www.iiste.org/journals/> All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

### MORE RESOURCES

Book publication information: <http://www.iiste.org/book/>

Academic conference: <http://www.iiste.org/conference/upcoming-conferences-call-for-paper/>

### IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

