



Assessment of Distribution and Intensity of Major Cereal Crops Diseases in South Gondar, Ethiopia

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Abstract

Cereal crops are major source of income for the Ethiopian society. Moreover, south Gondar has huge potential to grow these cereals. However, production and productivity of the cereal crops are very low in Ethiopia particularly in South Gondar Zone as it is expected. Diseases are among the major factors for yield decrement. Losses due to diseases estimated to be higher than 40% without including storage pest damage. The prevalence, incidence and severity of major diseases, associated factors and practices are not identified and documented in South Gondar zone of, Ethiopia. Survey was conducted in eight districts, 31 kebeles, on six crops and more than 200 fields were assessed. Total of 15 major diseases were recorded across the eight districts on six major cereal crops. Among the diseases, yellow rust, Septoria, smut and net blotch had high severity value. Integrated disease management research intervention should be applied in the area. In addition, research also should be done on further identification and pathogenicity of the diseases.

Keywords: cereal diseases, assessment, diseases intensity, diseases distribution, incidence, severity, prevalence, south Gondar.

Background and Justification

Cereals have constituted the staple food of the world since their domestication ~10 000 years ago. Cereals are also the most important group of cultivated plants for food production and acreage covered, providing >60% of the calories and proteins in our daily diet (Varshney et al., 2006). Africa is the center of origin and also a major producer of several cereals like sorghum, finger millet, maize, teff and African rice. These cereals

are grown over an area of 98.6 million hectares producing 162 million tons.

Cereals are also major source of income for the Ethiopian societies. They were grown on 73.4 percent of the total area cultivated, by a total of 11.2 million farmers. Together, these holders produce a yearly average of 12 million ton of cereals, which is 68 percent of total agricultural production. Within the category of Grain crops, Cereals are the major food crops both in terms of

the area they are planted and volume of production obtained. They are produced in larger volume compared with other crops because they are the principal staple crops. Cereals are grown in all the regions with varying quantity. Out of the total grain crop area, 79.88% (9,974,316.28 hectares) was under cereals (Alemayehu et al., 2011).

CSA data in 2015/2016 showed that teff, maize, sorghum and wheat took up 22.95% (about 2,866,052.99 hectares), 16.91% (about 2,111,518.23 hectares), 14.85 % (about 1,854,710.93 hectares) and 13.33% (about 1,664,564.62 hectares) of the grain crop area, respectively. Cereals contributed 86.68% (about 231,287,970.83 quintals) of the grain production. Maize, teff, wheat and sorghum made up 26.80% (71,508,354.11 quintals), 16.76% (44,713,786.91 quintals), 15.81% (42,192,572.23 quintals) and 16.20% (43,232,997.52 quintals) of the grain production, in the same order.

The area coverage and production of cereal crops in Amhara region are 3,418,732.34 ha and 73,973,735.79 quintals whereas South Gondar zone has an area coverage of 385,330.58 ha and production of 7,594,072.20 quintal. However, production and productivity of the cereal crops are very low in Ethiopia particularly in South Gondar Zone as it is expected. Yields of major cereal crops are below 5 t ha⁻¹ which is below the national average. This is due to low potential of the crop varieties, soil fertility problems and poor disease management practices.

Diseases are among the major factors for yield decrement. Losses due to diseases estimated to be higher than 40% without including storage pest damage. (Tewabech *et al*, 2001) reported that yield loss due to grain store in Ethiopia reaches about 2-30%. The need to deliver consistent, high yields of high-quality grain makes control of cereal diseases an important component of successful crop management. Recognition of the disease, and an understanding of the pathogen(s) responsible, is the first step in successful disease control.

Unfortunately, type of important diseases for each major cereal crop, the prevalence, incidence and severity of major diseases, associated factors and practices are not identified and documented in South Gondar zone of, Ethiopia. Therefore, the current study had the following objectives.

Objectives

-) To identify important diseases in major cereal crops in potential districts of South Gondar
-) To assess the prevalence, incidence and severity of major diseases in cereal crops growing areas
-) To determine the association of cereal diseases with agronomic and other cultural practices

Materials and Methods

Description of the study area

The survey was conducted in eight major cereal crops growing districts of the South Gondar zone in 2021 main cropping season. Diseases of six major cereal crops grown in the eight districts (Teff, wheat, triticale, malt and food barley, maize and finger millet) were assessed (Fig.1). The districts were selected based on their potential to grow the major cereal crops in the South Gondar zone. Based on this, Teff survey was conducted in Estie, Simada and Andabet, whereas, Wheat, triticale and barley survey was conducted in Farta, G/Begemidir, Estie and Lay Gaynt districts. Maize and Finger millet diseases survey also was conducted in Dera and Fogera districts. Geographically, surveyed areas were located at an altitudinal range between 1822-3461m.a.s.l, longitude range of 037°27'47.3" - 038°59'36.9"E and latitude range of 11°15'04.1"-12°29'22.9"N coordination.

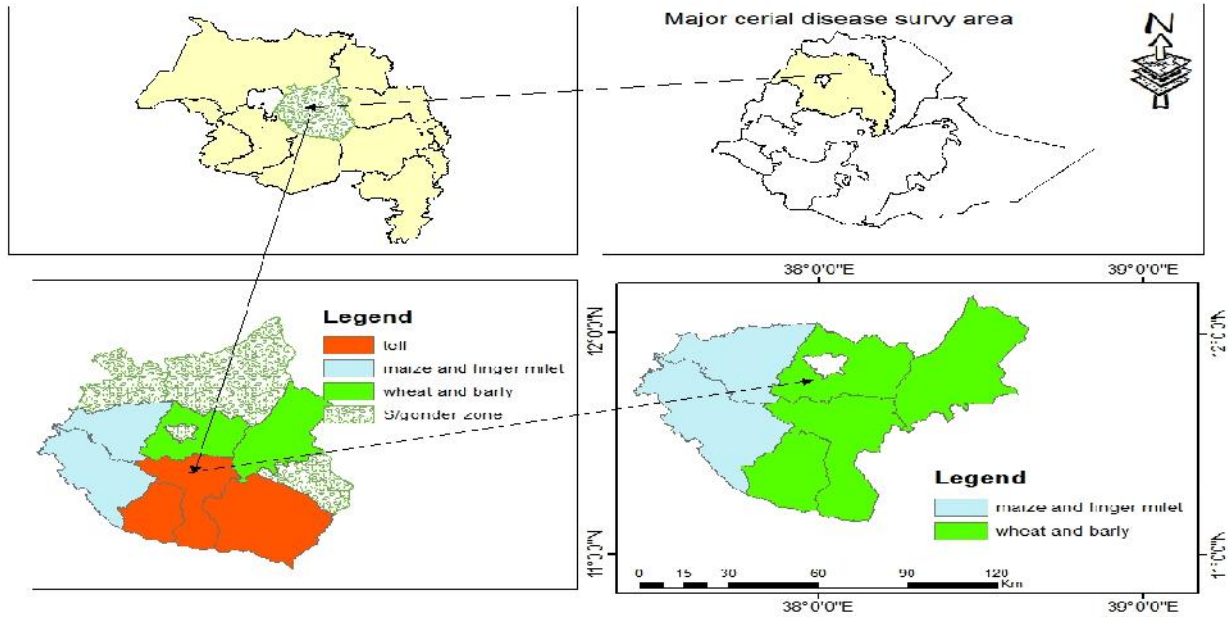


Figure 1. Map of major cereal crops diseases surveyed areas

Sample collection

The survey was conducted once in the cropping season on the critical period of disease onset on each selected cereal crop. A total of more than 200 fields within 31 kebeles were assessed for all

the six major cereals (Fig. 2). Sampled fields were selected based on the road accessibility and availability of the crop. Samples were collected approximately within 3-5km distance using the car’s odometer.

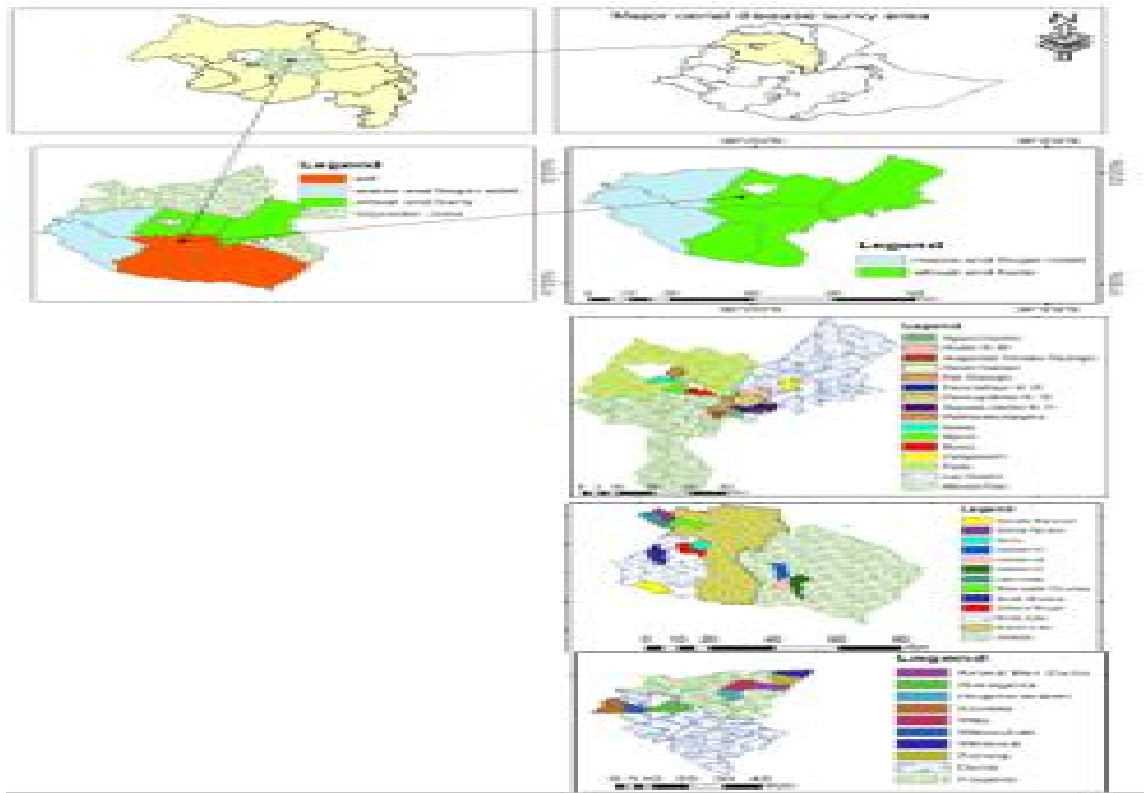


Figure 2. Map of assessed kebeles for the six cereals in South Gondar zone.

Data were collected both by direct field observation and interviewing of farmers. The diseases incidence and severity data were collected by direct field observation using 0.5x0.5m and 1x1m quadrants for small and large cereals, respectively. All plants in the quadrant

were critically evaluated and the incidence and severity values were recorded in percentage using the following formulae, while the prevalence was computed from the recorded data in geographical base.

$$\text{Disease Incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants assessed}} \times 100 \text{-----(1)}$$

$$\text{Disease Severity (\%)} = \frac{\text{Diseased area of the plant tissue}}{\text{Total area of the examined tissue}} \times 100 \text{-----(2)}$$

$$\text{Disease Prevalence (\%)} = \frac{\text{Number of infected fields}}{\text{Total number of fields assessed}} \times 100 \text{-----(3)}$$

In addition to the diseases data, the GPS coordination, sowing method, weed status, crop history of the field, planting time, crop growth stage, farmers perception and diseases management practices data were collected during the survey.

Accordingly, total of 15 diseases of the above mentioned major cereal crops disease were recorded. Of these 15 diseases, five diseases were wheat and triticale diseases, five were maize diseases, two were teff diseases, two were barley diseases and one was finger millet disease. The type of diseases and their corresponding incidence, severity and prevalence values are presented in 1 below.

Results and Discussion

In this survey eight districts, 31 kebeles, six crops and more than 200 fields were assessed.

Table 1. Major diseases of six cereal crops and their intensity in each district

S/n	Crop	District	Disease types	Incidence (%)		Severity (%)		Prevalence (%)
				Range	Mean	Range	Mean	
1	Triticale	Estie	Yellow rust	5 - 50	21.42	2.5 - 25	6.78	72.73
			Leaf rust	9.25- 10.5	9.88	3.2 - 5	4.10	9.09
			Stem rust	0 - 5	2.50	0 - 1.2	0.60	4.55
			Septoria	5 - 100	13.98	1.5 - 31	6.09	36.36
Farta		Yellow rust	5 - 100	41.56	1 - 50	11.97	75.86	
		Leaf rust	0 - 15	7.50	0 - 2.5	1.25	3.45	
		Stem rust	2 - 15	8.00	0 - 3.7	1.80	13.79	
		Septoria	5 - 80	14.87	1 - 25	5.55	27.59	
L/Gaynt	Yellow rust	5 - 35	17.50	3 - 7.5	4.00	57.14		
	Septoria	15 - 15	15.00	1 - 5	3.31	9.52		
G/Begemidir	Yellow rust	5 - 46	25.75	1 - 10	5.25	66.67		
	leaf rust	0 - 25	12.50	0 - 7.5	3.75	16.67		
	Septoria	0 - 5	2.5.0	0 - 1	0.50	16.67		

2	Bred wheat	Estie	Yellow rust	50		25		72.73		
			Septoria	100		31		36.36		
			Smut	15		100		4.55		
		Farta	Yellow rust	5 - 75	43.75	1 - 15	8.38	75.86		
			Septoria	75		20		27.59		
		L/Gaynt	Yellow rust	5 - 15	8.33	1 - 2.7	1.57	57.14		
3	Barley	G/Begemidir	Yellow rust	5		1		66.67		
			Septoria	5		1		16.67		
		Estie	Smut	1.5-25	10.89			92.59		
			Net blotch	10-100	38.17	2.5-25	8.94	44.44		
		Farta	Smut	1.5-5	5.75			50		
			Net blotch	50-100	75	15-45	25	66.67		
		L/Gaynt	Smut	5-22	13.4			29.41		
			Net blotch	15-100	51.09	3.5-50	17.11	64.71		
		Andabet	Leaf rust	5 - 100	28.08	1.1 - 25	6.26	90		
			Head smudge	10 - 100	18.61	3.5 - 25	4.31	40		
		4	Teff	Estie	Leaf rust	3.75 - 50	15.05	0.75 - 8.5	2.75	65
					Head smudge	5 - 20.35	12.51	1.3 - 27	8.09	40
Simada	Leaf rust			5 - 35	13.80	0.75 - 8.75	2.47	88.46		
	Head smudge			3.75 - 5	4.42	1.5 - 3.2	2.4	11.54		
	Turcicum leaf blight			2.5 - 40	11.36	0.75 - 17.5	4.34	70.00		
	Grey leaf spot			5 - 65	41.00	1.5 - 30	14.30	25.00		
Dera	Common maize smut			1 - 2.0	1.33	10 - 25	18.33	15.00		
	Curvularia leaf spot			5 - 15	10.00	2.5 - 25	13.75	10.00		
5	Maize		Common leaf rust	2.5 - 9.5	5.31	1 - 3.1	1.51	40.00		
		Fogera	Turcicum leaf blight	2 - 35	10.14	1 - 35	5.79	68.00		
			Grey leaf spot	4.3- 50	13.68	1.5 - 15	5.26	48.00		
			Common maize smut	1 - 7	3.00	50 - 100	83.33	12.00		
			Curvularia leaf spot	7.5 - 50	19.41	1.5 -13.5	5.82	36.00		
			Common leaf rust	2.9 - 10	4.64	1 - 3.5	1.72	20.00		
		Dera	Head blast	3.7-50	14.30	1-35	7.02	84.21		
		Fogera	Head blast	2.5-29	11.60	1.5-10.5	4.88	69.57		
		6	Finger millet							

Table 2. Summary of average incidence, severity and prevalence of diseases on each crop over the accessed districts

s/n	Crop	N0. of fields assessed	Common name of the disease	Scientific name of the disease	Average incidence (%)	Average severity (%)	Average prevalence
1	Triticale	65	Yellow rust	<i>Puccinia striiformisf.sp. tritici.</i>	26.56	7.0	68.1
			Leaf rust	<i>Puccinia triticina</i>	9.96	3.03	9.74
			Stem rust	<i>Puccinia graminisf.sp. tritici</i>	5.25	1.2	9.17
			Septoria	<i>Septoria spp.</i>	14.62	3.82	22.54
2	Wheat	13	Yellow rust	<i>Puccinia striiformisf.sp. tritici.</i>	26.77	8.99	68.1
			Septoria	<i>Septoria spp.</i>	60	17.33	26.87
			Smut	<i>Ustilago spp.</i>	15	100	4.55
3	Barley	51	Smut	<i>Ustilagospp.</i>	10.01	100	57.33
			Net blotch	<i>Helminthosporium teres</i>	54.75	17.02	58.61
4	Teff	69	Leaf rust	<i>Uromyces eragrostidis</i> Tracy	18.98	3.83	81.15
			Head smudge	<i>Helmithosporiummiyakei</i> Niskado	11.85	4.93	30.51
5	Maize	52	Turcicum leaf blight	<i>Exserohilumturcicum</i>	10.75	5.07	69
			Grey leaf spot	<i>Cercosporazeae-maydis</i>	27.34	9.78	36.5
			Common maize smut	<i>Ustilago maydis</i>	2.17	50.83	13.5
			Curvularia leaf spot	<i>Curvularialunata</i>	14.71	9.79	23
			Common leaf rust	<i>Puccinia sorghi</i>	4.98	1.62	30
6	Finger millet	42	Head blast	<i>Magnaportheoryzae</i>	12.95	5.95	76.89

As indicated in tables 1 and 2 above, all the six major cereal crops grown in south Gonder were attacked by different diseases. Of the cereals, maize was attacked by five diseases types followed by triticale, which was attacked by four diseases. Wheat was also attacked by three diseases followed by barley and teff, each were attacked by two diseases types, while finger millet was attacked only by one disease type.

Among the recorded diseases on each cereal crops, yellow rust, Septoria, smut and net blotch had high severity value (Table 1). Furthermore, the disease of each crop was prevalent in all

assessed districts. The occurrence of these diseases across all assessed district could be suitable environmental conditions for the pathogens and/or susceptibility of the cultivated crop varieties.

Summary and Conclusion

Cereal crops are major source of income for the Ethiopian society. Moreover, south Gondar has huge potential to grow these cereals. Despite of the crops important and potential of the area, cereals crops are being attacked by numerous diseases.

A total of 15 major diseases were recorded across eight districts on six major cereal crops. The maximum incidence, severity and prevalence of some of the diseases reached up to 60, 100 and 81.15%, respectively, based on the nature of the diseases.

Therefore, the information obtained from this survey result gives some clue on the importance research intervention in the area particularly by developing or adopting integrated disease management options for those recorded major diseases of the cereals in the area.

Generally, the survey should be conducted for consecutive years on different growth stage of the crop. In addition, research also should be done on further identification and pathogenicity of the diseases.

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