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# Assessment on Spatial Distribution and Their Management Options against Wheat Rust (*Puccinia Spp*) Diseases Species in Selected Administrative Zones of Southern Ethiopia

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## ABSTRACT

*The prevalence of disease was assessed at Gamogofa and Segen people's zones of selected Woredas using developed questionnaire. Of 101 wheat fields inspected by rust disease, 35, 12 and 30% stripe rust, leaf rust and stem rust were infected. The severity was varied from location to location; the highest incidence of stem rust was recorded on Digalu in Chencha woreda and moderate in Dita Woreda and the percent was 86% and 59%, respectively and relatively low in Burjhi Woreda, 6.67%. The severity of stripe rust was high in all surveyed areas except Burjhi Woreda and it was recorded on 34 wheat fields. Stem rust severity was high in Chencha and low in Dita and Burjhi Woredas; the highest severity of stem rust was recorded on Digalu and the percent was 10% in Chencha Woreda. To solve these diseases there need apply the recommended management practices.*

**Keywords:** *Prevalence, rust diseases, leaf rust, stem rust, stripe rust, severity and wheat.*

## INTRODUCTION

Plants constitute 93 percent of the world's diet. Cereals contribute two-thirds of all food, and among the cereals wheat is the largest crop. The eight major cereals, wheat, maize, rice, barley, sorghum, oats, illet and rye, cover 56 % of the world's arable land and are the major source of calories and protein for most of the world's people. Wheat, maize and rice account for 80 percent of global cereal production. Wheat production in the developing countries during the decade of the 1970s increased at a rate of 4.8 percent per annum, the highest of all the cereals. Bread and durum are the two principal commercial types of wheat. Bread wheat covers about 90 percent of the world wheat area and makes up about 94 percent of production. Durum wheat is less cosmopolitan in its distribution. *Triticum aestivum*, the common wheat is one of the leading edible grains of human's food (5). Ethiopia is the second largest producer of wheat in sub-Saharan Africa, following South Africa and about 900,000 ha of bread (*Triticum aestivum*) and durum (*T. turgidum var. durum*) wheat are grown in Ethiopia, primarily as highland rainfed crops (4). Bread wheat today is grown in almost all parts of the world.

Despite its importance, its production and productivity are prone to divers' biotic and abiotic factors among which wheat rust diseases are the most important. Rust diseases of wheat are among the oldest plant diseases known to man. Early literature on wheat cultivation mentions these devastating diseases and their ability to destroy entire wheat crops. Today, worldwide epidemic losses are extraordinary, though the diseases can occur at significant levels in particular fields or throughout a particular growing region. Grain yield is reduced by interference with grain filling, which results in a reduction in the number and size of kernels. Severe infection results in premature ripening and shrinking of the grain and sometimes grain losses reach up to 90% (3). In addition, losses can be severe (50%) due to shriveled grain and damaged tillers. In extreme situations, stripe rust can cause 100% losses (5). Monitoring wheat rust diseases and races is of great importance for sustainable wheat production. SNNPR is one of the regions of the country, commercially wheat and barley grown. In this region wheat occupies

an area of about 328,652 ha with annual production of about 12.54 million quintals (Unpuplished Data, 2010).

Therefore, wheat rust diseases survey is basic to all effective control and research programs. With this regards this research reports the current prevalence and occurrence of Wheat rust disease and any other disease on the Wheat plant in Around Segen people's zone and Gamogofa zone with important objective of to watch and monitor the status of rust diseases and observe wheat varieties response to the rusts, and to determine the prevalence of new virulence races and monitor new stem rust race, ug99, spread in the study areas and giving alternative solution against the rust diseases and to identify disease resistance varieties of Wheat around the study areas.

## MATERIALS AND METHOD

The survey was undertaken in farmers' fields of Wheat growing areas of in Around Segen people's Zone Burjhi Woreda and Chencha and Dita Woredas of Gamogofa Zone in South Nation, Nationalities and People Region (SNNPR), Ethiopia has been carried out during 2013/2014 to study the prevalence and occurrence of Wheat rust disease. The prevalence of disease was assessed at different peasant associations (PAs) of the study areas using developed questionnaire and geographical positioning system (GPS), where the altitudes range from 1490 up to 2325 meter at Burjhi woreda, Chencha Woreda ranging from 2310-2938 meter and Dita woreda ranging from 2369-2710 meter. Along the roadside extent to 1-2 km wheat fields of the growers were visited and diseases data were collected using disease recording sheet/format and GPS. Samples were collected from each 3 to 5 km stops/transactions as per wheat fields' available and representative sites as well. Labeled Glassine Bag and/or Paper Envelop were used for sample collection. A total of 83 fields were assessed randomly in every 3 to 5 kilo meters and the disease occurrence and infested plants showing typical symptoms (yellow rust, leaf rust and stem rust) of the Wheat rust disease were recorded at pocket areas and also Septorial and powdery mildew disease were recorded in all study areas. For this study both primary and secondary data were used. The primary data were collected from the fields involved in the Wheat production. Additionally, development agents were asked to list and prioritize other factors that affect Wheat production in the areas. To obtain both quantitative and qualitative primary data from the selected field the incidences, severity and were disease reaction recorded and the fields were formally viewed by the researchers. Secondary data will be used from the Woreda agricultural and rural development office.

The survey was undertaken to capture information on factors that could accelerate disease spread or increase vulnerability of farming communities to the Wheat rust disease and also Wheat rust diseases survey and samples collection of stem rust were carried out in the study areas. The questionnaires (developed by CIMMYT) addressed surveyor name, country/institution, location, latitude, longitude, elevation, surveyor site (like farmer field, weed and trial site), crop cultivars (like bread wheat, durum wheat, barley, triticale, oats and others), crop growth stage (like tillering, booting, flowering, milking, doughing and maturity), field area size (ha), crop varieties, presence of different Wheat rust diseases incidence, severity and disease reaction, farmer awareness of rust disease management practices, sources of planting material, cultural practices, and any other issues that could be relevant to disease spread and management. The Wheat cultivar types were identified and plants assessed for rust disease and other diseases and pests. Samples of plants with disease symptoms put in Paper Envelop, sealed, labeled and put in cool and dry environment for disease confirmation in the laboratory. After drying (under shade conditions) the collected samples were sent to Ambo Plant Protection Research center for further race identification/analysis. The collected data were checked, edited and entered to the computer. Different analytical tools depending on the type of data (quantitative and qualitative) were administered to meet the objectives. Data obtained during field visit the incidences, severity and were disease reaction recorded and farmer field were entered in to Microsoft Excel and analyses with appropriate statistical tools. And also the level of the technical knowledge and some other relationships would be analyzed using descriptive statistical tools. All data collected during surveying or/and guided filed observation were subjected to statistical analysis.

## RESULTS AND DISCUSSION

### Identification of Different Wheat Rust Diseases and Its Status of Prevalence and Distribution in Wheat Growing Areas

Wheat rust disease is among the most widespread and economically important diseases

of Wheat crops in the areas. Three distinct diseases, leaf rust, stripe rust and stem rust, occurred on wheat in the areas. The potential yield loss caused by these diseases depends on host susceptibility and weather conditions, but the loss also is influenced by the timing and severity of disease outbreaks relative to crop growth stage. The greatest yield losses occur when one or more of these diseases occur before the heading stage of development. Wheat plants are commonly measured by infection type and severity. This disease of cereals and grasses may have a complete life cycle, including up to five spore stages, or variations with fewer spore stages. The complete life cycle in a macro-cyclic cereal rust fungus will include spore stages on the grass host. This latter stage of the life cycle typically aids the pathogen to survive between crop seasons and permits the pathogen to undergo a sexual stage with the possibility of genetic recombination (11).

The survey of Wheat rust disease in two zones of southern nation's nationality and peoples region in different Woredas were conducted during 2013/14 in order to identify Wheat rust disease in the study areas. Wheat rust disease was observed in the study areas. Disease prevalence and distribution is showed in Table 1. The field surveillance and laboratory result indicated that there were yellow/ stripe rust (*Puccinia striiformis* -Commonly affects leaf blades, occasionally observed on heads when disease is very severe; infection of leaf sheaths or stems is rare), leaf rust (*Puccinia recondita f. sp. tritici* -Commonly occurs on leaf blades, but may also affect leaf sheaths; infections of stems and heads are rare) and stem rust (*Puccinia graminis* f. sp. *Tritici*-Commonly affects stems, leaf sheaths, and leaf blades; occasionally will affect parts of the head) that caused rusting on the Wheat plant fields, and moreover the field surveillance and laboratory result indicated that there was no occurred the stem rust race the so called Ug99. The main Wheat varieties grown in the survey areas were Digalu, Danda'a, Gallama, Pick up floor (Kekeba), Triticale, kubsa, Lakech and Bashikella. The last one was the most dominant grown and local variety including Lakech in Gamogofa zone. The surveillance indicated that all of the rust disease type observed on the farmers field and trial site, and but it was not found on the outside of the farmer fields that is grassing field, and also rust diseases was not observed on other field crops like Barley, Oat and other crops. But Sinnar grass, which is a kind of weed species as observed on the field it was 100% affected by all of the rust disease types; yellow, leaf and stem rust.

Differentiating the rust diseases can be difficult, but with practice they can be reliably identified. Begin by considering broad characteristics such as which plant parts are affected (Figure 1) or arrangement of the blister-like lesions on plants. These characteristics will often separate one or more of these diseases quickly. Continue by examining less obvious characteristics including lesion size, shape, and color to either confirm the diagnosis or separate the more similar diseases. For example, stripe rust is the only one of these diseases to have the blister like lesions organized into stripes on the leaves (Figure 2(A)). If the lesions are scattered on the affected plant parts, both stem rust and leaf rust are a possibility and additional characteristics must be considered. Leaf rust typically causes small, round lesions on the leaf blades and leaf sheaths whereas stem rust oval-shaped or elongated blister-like lesions scattered on affected tissues, lesions visible on both sides of leaf (Figure 2 (B and C, respectively)). All three diseases have unique interactions with common varieties of wheat. Becoming familiar with the range of possible symptoms for these diseases will improve the accuracy of the diagnosis and the management of these economically important diseases.

The intensity of the disease varies from lower to higher infection of wheat fields depending on the crop variety and climatic conditions. The disease was observed in all surveyed areas at variable levels. Of 101 wheat fields inspected by rust disease, 35% stripe rust, 12% leaf rust, 30% stem rust, 18% leaf rust and stem rust, and 5% stripe rust and leaf rust were infected. The null infected fields of Wheat rust were recorded at Burjhi Woreda, 10 fields. A total of 111 wheat fields were surveyed in the major wheat growing districts. Three wheat rusts include Yellow, Stem and Leaf and Septoria Leaf Blotches were mainly prevalent; Stripe rust of wheat was recorded on 34 wheat fields and its incidence was null in Burjhi woreda of Around Segen people's Zone but in Chencha and Dita Woredas of Gamogofa was 100%, this was the most widespread and distribution due to wind and rain; Stem rust of wheat was occurred on one (1) wheat fields Burjhi Woreda. The incidence was varied from location to location;

the highest incidence of stem rust was recorded on Digalu in Chencha woreda and moderate in Dita Woreda and the percent was 86% and 59%, respectively in Gamogofa Zone and relatively low in Burjhi Woreda, 6.67%. The incidence of Stripe rust was high in all surveyed areas except in Burjhi Woreda, and also the incidence of leaf rust was relatively low in Chencha and Burjhi Woredas but in Dita Woreda it was 100%. In addition Septoria Leaf Blotches was recorded in all surveyed areas; the percent was 32.35% and 53.33% in Gamogofa and Around Segen people's Zones, respectively (Table 1).

**Table1.** *Wheat rust diseases prevalence and distributions in some Woredas of Gamo gofa and Around Segen people's zones of SNNPR, 2013*

| No | Zone | Woreda | No. of field | Altitude range (m) | Stem Rust | | Leaf rust | | Yellow rust | | SLB | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | field | % | field | % | field | % | field | % |
| 1 | GAMO GOFA | Chencha | 68 | 2310-2938 | 44 | 86 | 37 | 73 | 68 | 100 | 12 | 23.53 |
| | | Dita | 28 | 2369-2710 | 10 | 59 | 17 | 100 | 28 | 100 | 7 | 41.18 |
| | ***Total*** | **2** | ***68*** | | ***54*** | ***79*** | ***54*** | ***79*** | ***68*** | ***100*** | ***19*** | ***32.35*** |
| 2 | SEGEN PEOPLE'S ZONE | Burjhi | 15 | 1490-2325 | 1 | 6.67 | 3 | 20 | 0 | 0 | 8 | 53.3 |
| | ***Total*** | ***1*** | ***15*** | | ***1*** | ***6.67*** | ***3*** | ***20*** | ***0*** | ***0*** | ***8*** | ***53.33*** |
| | ***Total*** | ***3*** | ***111*** | | ***55*** | ***42.84*** | ***28.5*** | ***49.5*** | ***34*** | ***50*** | ***77*** | ***92*** |

**Figure1.** *The diagnosis of rust diseases requires some basic understanding of plant anatomy and a quick review of this information may improve the accuracy of the identification process (A- Danda'a and B- Digalu).*


**Figure2.** *Examples of the different wheat rust symptoms caused by stripe rust (A), leaf rust (B) and stem rust (C-1Danda'a, and C-2 and 3 Digalu) as a result of unique interactions with wheat varieties.*

## Response of Wheat Varieties for Rust Disease and its Economic Impacts

Rust diseases, stem rust, leaf rust, and stripe rust, comprise a complex of diseases that reduces wheat grain production. The importance of any member of the complex at a given location is determined by specific interactions with current wheat varieties, crop growth stage, and weather conditions. Data showed in Table 2 stripe rust

severity was relatively low in all surveyed locations; Stem rust severity was high in Chencha and low in Dita and Burjhi Woredas; the highest severity of stem rust was recorded on *Digalu* and the percent was 10% in Gamogofa zone; the severity of leaf rust was varied and in general it was low.

Stem rust is generally considered the most damaging of the Wheat rust diseases because it can infect leaves, stems, and heads of the developing plants. It occurs primarily on stems but can also be found on leaves, sheaths, glumes, awns and even seed. Symptoms begin as oval to elongate lesions that are generally reddish-brown in color. In the late stages of the disease, erumpent pustules produce numerous black sooty spores. Severe infestations with many stem lesions may weaken plant stems and result in lodging (12). Plants severely damaged by stem rust are often predisposed to lodging, which complicates grain harvest and further increases yield losses. The greatest yield losses are likely to occur when plants become infected with stem rust early in their growth and development and normally, this late increase of disease does not result in serious yield loss (Figure 3). Even low levels of the disease before heading can result in severe disease during the early stages of grain development and serious yield loss. The risk of significant yield loss is reduced when the disease occurs during the later stages of grain development or when varieties with moderate levels of genetic resistance slow the development of disease. Estimates of potential yield loss can be obtained by evaluating the severity of stem rust during the early stages of grain development (10).

Stripe rust is a serious disease of wheat occurring in most wheat areas with cool and moist weather conditions during the growing season. It infect on the leaves of wheat plants, entering through pores in the surface (stomata). The wide distribution in stripe rust occurrence across season could be due to the climatic change altering the behavior of the environment and corresponding pest outbreak. For instance, the disease was much less important in the first growing stage, before heading/setting of flowers, while a complete shift was observed in the second growing stage, after heading/ setting of flowers in the main cropping seasons. The variation over growing stage or/and location could be probably depend on the type of wheat cultivars grown (8), and on the predominant environmental conditions, especially temperature (6). Moreover, most probably the frequency of favorable environments such as longer duration of foggy and cloudier sky could raise the humidity and there cause for the formation of free moisture on plant surface. These conditions provoked an optimum rust spore germination and infection followed by a rapid rust development in the season. Furthermore, the high level of stripe rust intensity recorded during the study period in the wheat growing areas of Gamogofa zone might be the result of the cultivation of bread wheat cultivars such as Kubsa, and the local varieties Lakech and Bashikella (which is covered the cultivated areas more than 75%) and few others, which are susceptible to wheat rusts particularly to stripe rust and their severity level was 100%.

According to this study, these susceptible cultivars accounted for more than 80% of the wheat in the part of this zone, Gamogofa, Kubsa in Around Segen People's Zone. The susceptibility mainly attributed to the varieties to reduce the yields. This field assessment also showed the susceptibility of commercial bread wheat varieties to wheat rusts. The high level of stripe rust severity recorded revealed the economic importance of the disease during the season. The frequent occurrence and variability of stripe rust in most bread wheat cultivars during the season asserted the broad virulence spectrum of stripe rust population and its economic significance in Gamogofa zone highlands. Stripe rust is one of the most important and destructive wheat diseases all over the world. Stripe rust is a major wheat disease that can inflict yield losses of up to 70% on susceptible varieties under favourable environmental conditions (9). The use of resistant variety is the best control strategy of rust diseases of wheat for resource poor farmers and the most environmentally friendly and profitable strategy for commercial farmers.

Leaf rust is generally found on leaves but may also infect glumes and awns. Symptoms begin as small, circular to oval yellow spots on infected tissue of the upper leaf surface. As the disease progresses, the spots develop into orange colored pustules which may be surrounded by a yellow halo. The pustules produce a large number of spores that are easily dislodged from the pustule resulting in an "orange dust" on the leaf surface or on clothes, hands and equipment. As the disease progresses,

black spores may be produced resulting in a mixture of orange and black lesions on the same leaf (7). Yield losses due to leaf rust can be substantial. The final amount of loss will depend on the crop development stage when the initial infections occur, and the relative resistance or susceptibility of the wheat cultivar. Leaf rust reduces yields and weights because infected leaves die prematurely. The earlier leaves are lost, the more severe the yield loss. Losses may vary depending on the variety's ability to fill from the stem, glumes, and awns. Table 3 provides a rough estimate of percent yield loss due to leaf rust at various flag leaf severities and different growth stages. Greater yield losses result when the initial infections occur early in the growing season, especially before the jointing and tillering stages. Infections after heading when grain filling is progressing will cause less crop loss. An early study with susceptible soft red winter wheat cultivars (1) showed losses ranging from 15 to 28% due to leaf rust. Most of the losses were due to a reduction in the number of kernels per head and a reduction in the kernel weight. Leaf rust was the major cause of a 25–30% yield loss in wheat (2).

**Table2.** *Wheat rust diseases severity (%) in major wheat grown areas of Gamo Gofa and Around Segen people's Zones of SNNPR*

| No. | Zone | Woreda | No. of field | | Leaf rust | Yellow rust |
|---|---|---|---|---|---|---|
| 1 | GAMO GOFA | *Chencha* | 68 | H (10)<br>M (22)<br>L (57) | H (4)<br>M (35)<br>L (35) | H (39)<br>M (43)<br>L (20) |
| | | *Dita* | 28 | H (0)<br>M (29)<br>L (29) | H (6)<br>M (18)<br>L (76) | H (18)<br>M (35)<br>L (47) |
| | ***Total*** | ***2*** | ***96*** | | | |
| 1 | SEGEN PEOPLE'S ZONE | *Burjhi* | 15 | H (0)<br>M (0)<br>L (6.67) | H (0)<br>M (0)<br>L (20) | H (0)<br>M (0)<br>L (0) |
| | ***Total*** | ***1*** | ***15*** | | | |

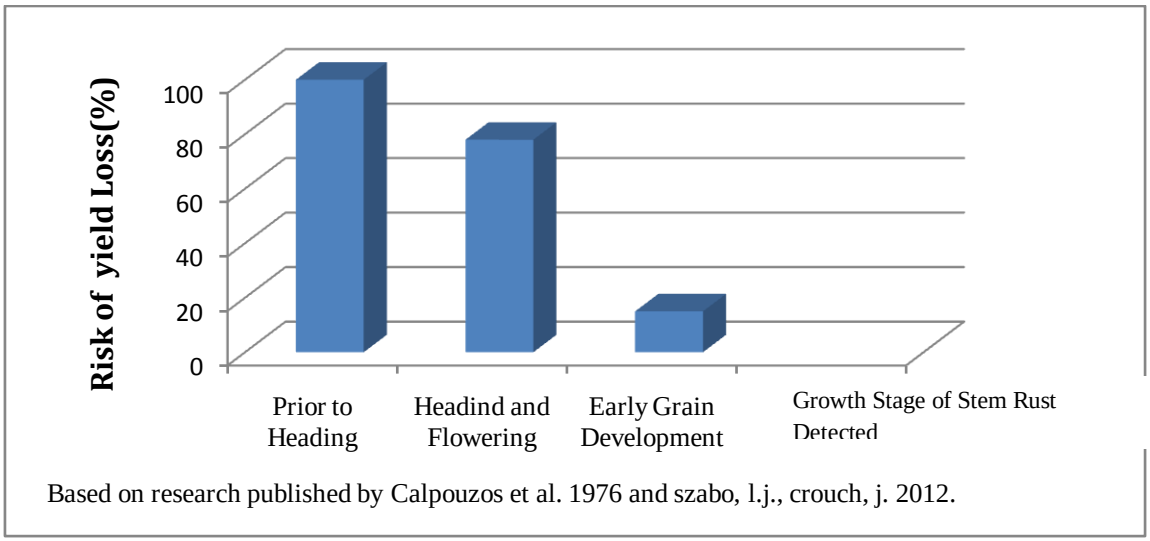


**Figure3.** *Potential yield losses caused by stem rust on wheat are influenced by disease severity and timing of disease onset relative to crop growth and development.*

## Wheat Varieties Distribution and their Reaction Wheat Rust Disease

Of seven Wheat varieties evaluated, 35% stripe rust, 12% leaf rust, 30% stem rust, 18% leaf rust and stem rust, and 5% stripe rust and leaf rust. The variety Bashikelaa exhibited a severity level of 100 Susceptible. Among the infected varieties, Digalu, Danda'a, Triticale, Kekeba, Lakech and Kubsa exhibited severity range of a stripe rust (20-25%), leaf rust (5-10%) and stem rust (15-20%) with a reaction varying from moderately resistant to susceptible. Among the

infected varieties, the majority (65%) sustained a severity range of 5-20% that displayed low level of moderately susceptible to moderately resistant reactions for all type of Wheat rust disease. Digalu and Danda'a exhibited a severity level up to 20-40% with moderately resistant in terms of its reaction to stem rust. The remaining wheat varieties (35%) were moderately resistant to stripe rust, leaf rust and stem rust and showed a moderately resistant reaction. Of the 7 Wheat varieties, five wheat varieties (Digalu, Danda'a, Kubsa, Kekeba and Lakech) sustained spike infection at severely by stripe rust and stem rust and causing significant loss to yield (Table 4.1 and 4.2).

**Table3.** *Rough estimation of yield loss (%) in different growth stage due to leaf rust*

| Rough estimation of yield loss (%) for different leaf rust severities | | | | | |
|---|---|---|---|---|---|
| **Growth stage** | **Rust severity on Flag Leaf** | | | | |
| | 10% | 25% | 40% | 65% | 100% |
| Flowering | 10 | 15 | 20 | 30 | 35 |
| Milk | 2 | 5 | 8 | 14 | 20 |
| Soft Dough | 1 | 3 | 4 | 7 | 10 |
| Hard Dough | 1 | 1 | 4 | 3 | 5 |

**Source:** *http://www.plantpath.ksu.edu/pages/extension*

**Table4.1.** *Wheat varieties distribution and their reaction to rust diseases in Gamo Gofa and Around Segen people's zones of SNNPR*

| Zone | Woreda | Variety (distribution) | No. of field | Stem Rust | Leaf rust | Yellow rust |
|---|---|---|---|---|---|---|
| ***GAMO GOFA ZONE*** | Chencha | Digalu (41%) | 21 | R-MR-MSS | R-MR-MSS | MR-MSS |
| | | Danda'a (27%) | 14 | R-MR-MSS | R-MR-MSS | MR-MSS |
| | | Galama (8%) | 4 | R-MRMS | R-MSS | MSS |
| | | Kekeba (4%) | 2 | R-MR | MS | MSS |
| | | Lakech (12%) | 6 | R-MR | MSS | MSS |
| | | Triticale (8%) | 4 | R-MS | R-MSS | MSS |
| | | | 17 | R | R-MR | S |
| | *Dita* | Danda'a (77%) | 10 | R-MRMSS | MR-MSS | MR-MSS |
| | | Digalu (40%) | 4 | MR-MS | MR-MS | MR-MSS |
| | | Galama (20%) | 2 | MS | MR-MS | MSS |
| | | Triticale (10%) | 1 | R | S | S |
| | | | 11 | R | R-MR | S |
| | **2** | ***6 var.*** | ***96*** | | | |
| SEGEN PEOPLE'S ZONE | *Burjhi* | Kubsa (100%) | 15 | R-MS | MR-MS | R-S |
| | *1* | *1 var.* | 15 | | | |
| Total | *3* | *7 var.* | 111 | | | |

**Table4.2.** *Wheat varieties distribution and their reaction to rust diseases in Gamo Gofa and Around Segen people's and Gurage zones of SNNPR*

| Zone | Variety | Distribution (%) | Stem Rust | Leaf rust | Yellow rust |
|---|---|---|---|---|---|
| ***GAMO GOFA*** | **Digalu** | **36.67** | R-MR-MSS | R-MR-MSS | MR-MSS |
| | Kekeba | 2.94 | R-MR | MS | MSS |
| | Danda'a | **35.29** | R-MRMSS | R-MR-MSS | MR-MSS |
| | Galama | 8.82 | R-MRMS | R-MSS | MSS |
| | Lakech | 8.82 | R-MR | MSS | MSS |
| | Triticale | 7.35 | R-MS | R-MSS | MSS |
| | Bashikella | 1.83 | | | |
| SEGEN PEOPLE'S ZONE | Kubsa | **33.33** | R-MS | MR-MS | R-S |

## CONCLUSION

The survey was undertaken to capture information on factors that could accelerate disease spread or increase vulnerability of farming communities to the Wheat rust disease. Rust diseases are among the most widespread and economically important diseases of Wheat crops in the areas.

The three Wheat rust disease types were identified by the field observation and laboratory results. These three distinct diseases are leaf rust, stripe rust and stem rust, occurred on wheat in growing areas. These diseases caused rusting on the Wheat plant fields, and moreover the field surveillance and laboratory result indicated that there was no occurred the stem rust race the so called Ug99. Among the identified Wheat varieties, the local variety called Bashikella is the most susceptible to stripe rust and its severity reaction level was high followed by Digalu and Danda'a. And also infection level of Danda'a and Digalu with stem rust moderate to high respectively. The incidence, severity and reactions of the leaf rust disease were low to moderate at all surveying fields. The yield losses due to rust diseases depend on the growth stage of the plant and environmental conditions. Greater yield losses result when the initial infections occur early in the growing season, especially before the jointing and tillering stages. Infections after heading when grain filling is progressing will cause less crop loss. The risk of significant yield loss is reduced when the disease occurs during the later stages of grain development or when varieties with moderate levels of genetic resistance slow the development of disease. The greatest yield losses are likely to occur when plants become infected with stem rust early in their growth and development and normally, this late increase of disease does not result in serious yield loss. Leaf rust reduces yields and test weights because infected leaves die prematurely. Most of the late planting varieties were infected by the rust diseases. Climate change brings rising temperatures, and has increased the variability and intensity of rainfall, contributing to the spread and severity of rust diseases. Controlling volunteer wheat in the summer reduces leaf rust inoculums, but it does not guarantee freedom from rust blowing in from distant sources. Delayed planting reduces fall rust infections, but delayed maturity in the spring may lead to higher final rust levels. Fall grazing may reduce overwintering inoculums, but this has not been scientifically documented. For this reason Periodic surveillance of Wheat rust disease is highly important for early detection of rust disease types. To solve the impact of rust disease, there need more attention is paid and apply the recommended management practices. The use of resistant variety is the best control strategy of rust diseases of wheat for resource poor farmers in developing countries and the most environmentally friendly and profitable strategy for commercial farmers. The survey will conducted every growing season and significant investment on the rust disease will continue to be an important component of the producing of resistance by breeding process.

## RECOMMENDATIONS

Planning, awareness and preparedness to rapidly deliver appropriate seeds and fungicides where they are needed to arrest the spread of wheat rust diseases. New capacity and skills in ministries, extension services and at the farm level should be applied to develop effective strategies for managing rust diseases. Crop research should be continued, long-term effort of developing of new varieties that are resistant to the emerging races of wheat rust. Investments in rust disease reduction are small and less coordinated across countries. To reduce the current spread of rust disease, more investment to support countries to improve surveillance, breeding of durable varieties that resist rust diseases are needed as it evolves in these wheat producing regions. The prevalence of different rust races is always changing in response to the popularity of different wheat varieties with different genes. Susceptible varieties can be protected from rust with foliar fungicides. Tilt, Bumper 41.8 EC, Quadris, and Mancozeb are the major fungicides available for leaf rust control. Although systemic fungicides can give very good control of leaf rust, they are relatively expensive. Therefore, there should be use of fungicide. Fungicides usually increase seed size and decrease seed clean out, so fungicides are often profitable when used on seed production fields. There should be resistant varieties are the best control for rust diseases. Surveillance and information exchange between regions even the country should be undertaken. In addition, it can be suggested that considerable changes of peoples' perception and attitudes concerning bacterial wilt and fusarium wilt including Segatoka disease and its control measures can also be achieved through crop rotation, adjustment of planting date like early planting, uniform stand establishment (for good establishment, wheat should be planted in a firm, moist, mellow soil. Heavy, vigorous seedlings can resist pathogen attack better than weak seedling. Planting depth should be 1 to 11/2 inches in a medium to fine texture soil. Soil

condition should allow good soil to seed contact.), weed control, and crop residue management.

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## REFERENCES

[1] Caldwell, R.M., Kraybill, H.R., Sullivan, J.T., Compton, L.E. (1934) Effect of leaf rust (*Puccinia triticina*) on yield, physical characters, and composition of winter wheat. *Journal of Agricultural Research*, 48, 1049–1071.

[2] Chester, K.S. (1939) The 1938 wheat leaf-rust epiphytotic in Oklahoma. *Plant Disease Reporter*, 112, 1–19.

[3] German, S., Campos, P., Chaves, M., Madariaga, R., Kohli, M. (2011) Challenges in controlling leaf rust in the Southern Cone region of South America. *BGRI 2011 Technical Workshop*. 13-16 June. St. Paul, Minnesota.

[4] Tanner, D.G., Corbett, J.D. (2001) An Agro-Climatological Characterization of Bread Wheat Production Areas in Ethiopia. NRG-GIS Series 01-01. Mexico, D.F.: CIMMYT.

[5] Martin, J.H., Leonard, W.H., Stamp, D.L. (1976) Principles of Field Crop Production. New York: McMillan Publication Company.

[6] Roelfs, A.P., Singh, R.P., Saari, E.E. (1992) Rust Diseases of Wheat: Concept and Methods of Disease Management. Mexico, D.F: CIMMYT. Pp. 81.

[7] Schumann, G.L., Leonard, K.J. (2000). Stem rust of wheat (black rust). *The Plant Health Instructor*.DOI:10.1094/PHI-I-2000-0721-01.Accessed2/26/2012. http://www.apsnet.org/edcenter/intropp/lessons/fungi/Basidiomycetes/Pages/StemRust.aspx

[8] Singh, R.P. (1991) Pathogenecity variation of P. recondita f. sp. Tritici and P. graminis f. sp. tritici in wheat growing areas of Mexico during 1988-1989. *Plant Disease*, 75: 790-794.

[9] Singh, R.P., Hodson D.P., Jin, Y., Huerta-Espino, J., Kinyua, M.G., Wanyera, R., Njau, P., Ward, R.W. (2006) Current status, likely migration and strategies to mitigate the threat to wheat production from race Ug99 (TTKS) of stem rust pathogen. Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources 1: 1-13.

[10] Szabo, L.J., Crouch, J. (2012) Development of a molecular assay system for the rapid detection and identification of Ug99 and related races of Puccinia graminis. Meeting Abstract. p. 238.

[11] Tadesse, K., Ayalew, A., Badebo. A. (2010) Effect of fungicide on the development of wheat stem rust and yield of wheat varieties in highlands of Ethiopia. *African Crop Science Journal*. 18 (1):23-33.

[12] USDA/ARS. (2011) Cereal rusts and their hosts. Cereal Disease Laboratory. Accessed 2/26/2012-http://www.ars.usda.gov/Main/docs.htm?docid=9910.

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