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Preliminary Update of Rust Disease in Florida Warm-Season Grasses[1]

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Rust is a common disease on warm-season grasses that can affect pasture health and potentially serve as an allergen for animals grazing on it. Despite its significance, rust disease in warm-season grass is often overlooked. This publication reports on rust disease observed in Florida pastures and offers practical, non-technical knowledge and general management suggestions to mitigate the threat of rust disease. It is aimed at producers, landowners, and the public.

Observations of Rust Symptoms

Caused by many species in the genus *Puccinia*, rust is a common fungal disease that affects most grass species worldwide, including cool- and warm-season grasses. This disease has been observed in warm-season grass pastures in Florida. A previous report in Dairy Herd News indicated that it was observed from mid-to-late summer (Bechtel 2018). However, there remains a lack of systematic data documenting its severity across different seasons and grass species in Florida pastures. This information is crucial for ranchers to accurately identify rust symptoms and determine the appropriate timing for implementing management strategies that will reduce disease impact. To address this gap, we conducted on-site observations across multiple ranches during periods when rust outbreaks were expected. Our goal was to generate a data-driven report based on firsthand field observations. Specifically, we visited pastures growing various warm-season grasses commonly used in Florida and collected leaf samples throughout the growing season. Rust symptoms were analyzed under a microscope, and their severity was measured to more accurately describe disease patterns and support effective identification and management.

Our observations indicate that rust disease outbreaks can be widespread as early as spring, particularly in central Florida. Notably, we visited two commercial ranches in the region in March 2024 (see provided map in Figure 1a). Each ranch contained multiple grass species. Within each ranch, different areas were dominated by different grasses, including bahiagrass, bermudagrass, and limpograss. The rust symptoms were observed on most leaves of each species (Table 1; Figure 2). As symptoms became more severe, they began to spread among the leaves of each grass plant, resulting in few, if any, plants with entirely uninfected leaves. However, some individual plants harbored more infected leaves than others. This pattern was consistently observed across all three grass species. Over 90% of the leaves from all three grass species exhibited rust lesions. Specifically, 26%, 63%, and 69% of the collected limpograss, bahiagrass, and bermudagrass leaves, respectively, were categorized as having severe infection (Table 1). Severe infection is defined by the number of rust flecks observed on collected leaf blades within the evaluation area, with more than 50 flecks present on a 5 cm^2 leaf surface (10 cm length x 0.5 cm width) categorized as severe. Rust symptom severity was lower in the summer (August) compared to spring, with reductions of 43% for limpograss, 58% for bahiagrass, and 61% for bermudagrass in terms of total symptom percentage (Table 1). However, over 26% of the collected leaves still displayed rust lesions across the three grass species, with limpograss showing the highest severity at 47%. Longer-term observations across a wider range of Florida pasture sites will be needed to thoroughly monitor the outbreak of rust disease.

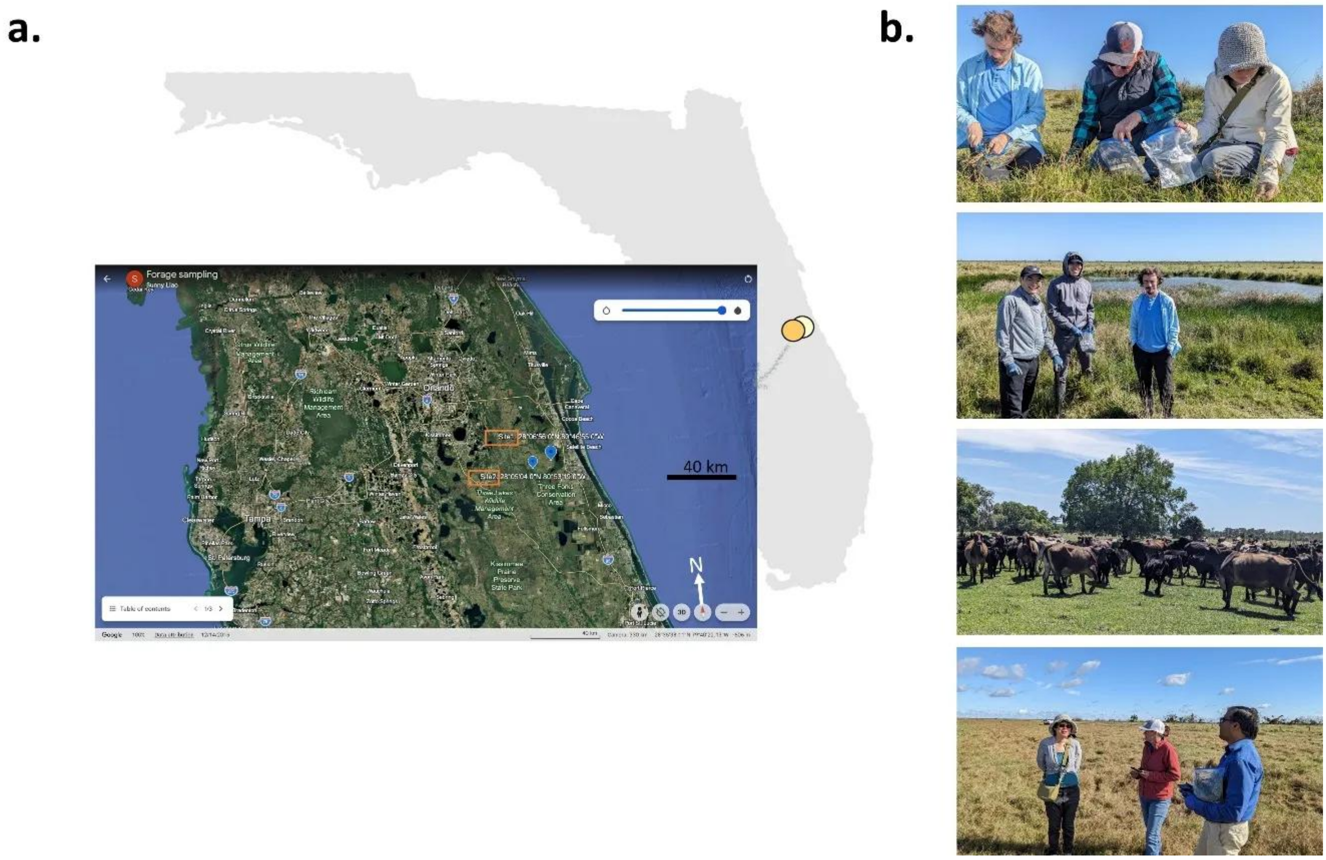

Figure 1. Google map (a) of sampling sites 1 and 2. The lab team (b), together with Extension faculty Justesen and Walter, teamed up to collect forage samples from sites 1 and 2.
Credit: (a) Adapted by Hui-Ling Liao, UF/IFAS, using Google map and imagery data from © Landsat/Copernicus, Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Data LDEO-Columbia, NSF, NOAA; Imagery Dates: December 14, 2015–January 1, 2021. (b) Hui-Ling Liao, UF/IFAS

Figure 2. Limpograss with severe rust lesions often experience reduced growth. Here, the severe rust system is defined as more than 50 rust flecks present on a 10 cm leaf blade for most of blades of a plant. The plant may appear shorter, with parts of the leaf blades showing tissue damage such as wilting and browning. This condition can also promote secondary infections or saprophytic microbial decomposition. (a) Comparisons of limpograss with and without rust lesions (flecks). (b) The rust lesions on a leaf blade. (c) A healthy leaf blade without rust infection.
Credit: Hui-Ling Liao, UF/IFAS

The number of small brownish or orange flecks visible on the leaf blade surface determines the severity of rust symptoms. A fleck represents a small lesion that appears on the leaf surface (Figure 2b). In some cases, these flecks may appear darker in color, which could indicate the presence of structures from another fungal group, such as a mycoparasite of the rust fungi, like those from the genus *Sphaerellopsis* (Gómez-Zapata et al. 2024). Because rust fungi heavily depend on living plant cells for their growth and development, the fungi generally do not kill the grasses they infect. The fungal structures can form lesions with yellowish-brown surrounding color (necrosis) on the leaf blades (Figure 3). The infected leaves weaken, become stunted and more yellow in color, showing reduced efficiency in performing normal biological processes (e.g., photosynthesis). Heavily infected leaf blades can sometimes wither and die, causing the whole plant to appear smaller (Figure 2a). Infection can also make the grass more susceptible to other biotic or environmental problems.

Figure 3 illustrates the stages of development for a rust fleck, which can be observed using a magnifying glass. Initially, infected leaf blades form yellowish or light orange flecks (indicated by the solid triangular arrows in Figure 3). In some cases, these flecks are surrounded by purple necrosis (indicated by striped triangular arrows in Figure 3), while others showed less necrosis and more prominent rust flecks. These initial symptoms can be found on both sides of the leaf blades. The yellow flecks, called uredinia, typically measure 0.5 to 3 mm in length and 0.5 to 1 mm in width. During the mid-stage of development, fungal spores (urediniospores) can be observable within a uredinium, although the plant's epidermal cells remain intact (Figure 3b and c). Note that epidermal cells make up the outermost layer of plant tissues, forming a protective barrier that shields the more delicate inner cells of the plant (Zuch et al. 2021). In the late stage of development, the epidermal cells rupture, releasing dark-red spores from the rust fleck (Figure 3d). A single uredinium can release dozens to hundreds of spores. These spores can adhere to leaf blades and spread through wind, rain, livestock grazing, and human activities, subsequently infecting other leaves.

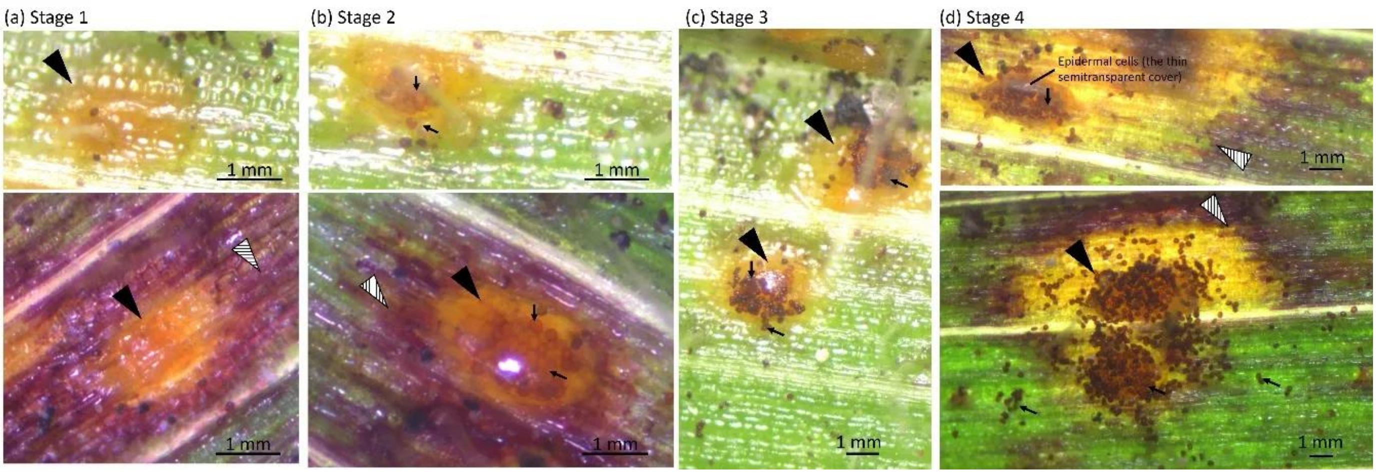

Figure 3. Stages of rust development on limpograss leaf blade (a to d). Solid triangular arrows across different stages indicate yellow flecks on the leaf blade, which are often the first visible symptom of rust on limpograss, such as in stage 1 (a). Some of the flecks can be surrounded by purple necrosis, indicated by the striped, triangular arrows (a, b, and d). The fleck then enlarges, forming spores within (b and c). The spores are indicated by small regular arrows. (d) Eventually, the fleck ruptures, releasing numerous rust spores (also indicated by small regular arrows). These spores easily adhere to shoes, field equipment, and animals, facilitating the spread to nearby grass blades and initiating new infections.
Credit: Hui-Ling Liao, UF/IFAS

Biology and Ecology of Rust Fungi

Rust fungi are obligate biotrophs belonging to the phylum of Basidiomycetes. As obligate biotrophs, rust fungi rely on direct interactions with living plant hosts to obtain essential nutrients for their survival, growth, and reproduction. This dependency generally makes rust fungi unculturable in laboratory conditions. Rust fungi have a complex life cycle, often requiring two or more different plant species, such as woody shrubs and herbaceous plants, to complete their life cycles. In the case of grass rust disease, fungal spores (urediniospores) produced on a grass host can easily spread to nearby grasses, effectively maintaining this part of the life cycle. Consequently, an alternate host may not be essential in the disease progression of rust fungi that infect grasses.

Multiple rust fungus species can potentially infect the same grass species. Specific interactions between rust fungi and grasses often depend on the species of each. Within a single rust fungus species, certain races may be more pathogenic to their grass hosts than others. Similarly, different cultivars within a grass species may vary in their resistance to the same fungal race. Rust species can be identified in the laboratory through molecular analysis. However, after prolonged interactions (e.g., over years), some grass cultivars may gradually lose or weaken their resistance to a particular fungal race. This highlights the need for ongoing research to identify rust-resistant cultivars that can adapt to the changing pathogenicity of rust fungi. It is possible that more than one rust species is infecting Florida pastures. Analyses of the fungal spore DNA sequences indicate that the rust samples at our limpograss sites could belong to at least two species of *Puccinia*. Further studies are needed to identify the associations between rust fungus genotypes and various grass species in Florida.

Management Recommendations

Before Pasture Establishment

Selecting cultivars that are more resistant to both rust and heat could be an effective strategy to prevent rust disease from occurring in the first place. However, further research is needed to identify specific cultivars within these species that offer greater rust tolerance across seasons for Florida pastures. At this stage, incorporating different forage species to increase plant diversity is also a viable option to avoid monoculture planting of more sensitive cultivars.

In the Established Pasture

Ensure proper fertility: Maintain good soil fertility to facilitate forage growth under optimal fertilization conditions. Do not overset the grass blade or overfertilize. Ensure soil N/P/K nutrient levels are within the ideal range per IFAS recommendations. Low soil fertility (especially low soil nitrogen), which reduces grass growth and health, can facilitate rust development.

Avoid temperature and moisture stresses: Rust symptoms can be more severe in shaded areas (e.g., along fences or under trees) where higher moisture levels increase leaf wetness and reduced light favors the growth of rust fungal structures. The seasonal transitions from early cooler spring conditions to warmer later spring conditions and hot, humid summer conditions promote the proliferation of rust pathogens in warm-season grasses. Prolonged leaf wetness from dew also promotes the progression of rust disease. The outbreak may occur after excessive rain, which often happens during spring and summer in Florida.

Consider other practices: Fungicides are not recommended for pastures with grazing and feeding activities. Fungicides are not commonly used to control rust disease when the previously mentioned management practices are in place. While rust may be removed by mowing the infected leaf blades, the spores can be spread via wind, water, human activities, and tools (e.g., shoes, equipment).

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Table 1. The rust flecks (uredinia) identified on limpograss, bahiagrass, and bermudagrass at sites of Figure 1.

Grass	Sampling dates and sites	Symptom evaluation (% of total leaf blades)*				
		No symptom	Minor	Moderate	Severe	Total % symptom
Limpograss	March 2024, Site 1	10%	35%	31%	24%	90%
	March 2024, Site 2	3%	13%	56%	28%	97%
	August 2024, Site 2	53%	27%	13%	7%	47%
Bahiagrass	March 2024, Site 1	8%	12.5%	17%	62.5%	92%
	August 2024, Site 1	66%	25%	7%	2%	34%
	August 2024, Site 2	80%	17%	3%	0%	20%
Bermudagrass	March 2024, Site 1	8%	10%	13%	69%	92%
	March 2024, Site 2	13%	10%	15%	62%	87%
	August 2024, Site 2	74%	18%	7%	1%	26%

*In total, 50 leaf blades were randomly collected from a 30 m x 30 m area at each site and examined. The midsection of each leaf blade (10 cm in length and ~0.5 cm in width) was used for symptom evaluation. Symptom severity was categorized as follows: no symptoms (no rust fleck observed), minor (<10 flecks), moderate (10 to 50 flecks), and severe (>50 flecks).

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