UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Palo Verde Valley Update

April 2020

Something's Wrong with My (Neighbor's) Field!

March 2020, and some of April, has been somewhat abnormal, characterized by above average rainfall and cooler than normal temperatures. These conditions have led to a number of unusual things in local agriculture, with fields affected to the point of someone driving by the field and thinking to themselves "There is something wrong with that field, it doesn't look right". Fields where something looks 'odd' include wheat, alfalfa, and bermudagrass.

ALFALFA

Several alfalfa fields have taken on a fairly bright yellow appearance (Fig. 1). My first thought from afar was that they look to be infested with *Empoasca* spp. leafhoppers and we are already seeing 'hopper yellows', or injury from some other insect. April is usually way too early in the year for damaging levels of leafhoppers to be expected (but it has been an odd year already).

Fig. 1. Field being harvested on April 15, 2020, with distinct yellow coloration in much of field.

When examining plants it was noted there was yellowed leaflets as could also occur from *Empoasca* spp. leafhopper feeding injury. The yellowing was not 'diamond shaped' however as occurs with 'hopper-burn'. Many leaflet tips had dried, had a tan coloration, and had begun to roll upwards (Fig. 2).

Fig. 2. Alfalfa leaflets showing yellowing and tip dessication.

Upon closer examination of leaflets, there many had interveinal yellowing (Fig. 3). This is a characteristic of alfalfa mosaic virus (AMV). This virus is known by different names in various vegetable crops in different places, such as tomato necrotic tip curl, and these symptom for tomatoes would apply to the leaflet tips shown in Figure 2.

This virus is well established in the Palo Verde Valley. It is seed-born in alfalfa and essentially all alfalfa fields in the Palo Verde Valley are considered infected. Several species of aphids also vector the virus, transmitting it while probing the leaf tissues.

Field spread is related to overall aphid activity, not to the presence of colonizing aphids. The disease is usually not economically important in low desert alfalfa. In northern states, plants infected with AMV are reported to have reduced vigor and over time will lead to stand decline. It should be noted that stands in northern latitudes may approach 10 years, compared to our typical three (3) years locally.

Fig. 3. Alfalfa leaf with interveinal yellowing associated with alfalfa mosaic virus.

Alfalfa mosaic virus is often noted in other area crops/weeds (Fig. 4). It is one reason that some winter vegetables are not widely grown locally.

Fig. 4. In some weeds, such as sowthistle, alfalfa mosaic virus has characteristics such as white and yellowed colored areas on foliage.

BERMUDAGRASS

If there is one area crop that really catches one's eye that something is amiss while traversing the valley this spring, it is bermudagrass. Many fields have large areas that are not green and shorter in stature than adjacent foliage (Fig. 5).

Fig. 5. Bermudagrass field showing large discolored areas in the midst of normal, green growth.

Examining the fields resulted in three observations:

1) Areas that were discolored often had a red appearance on outer parts of leaves (Fig. 6).

Fig. 6. Reddish coloration was noted on many bermudagrass leaves.

2) Field areas with yellow and/or red coloration which were much shorter than adjacent green vegetation (Figs. 5, 7).

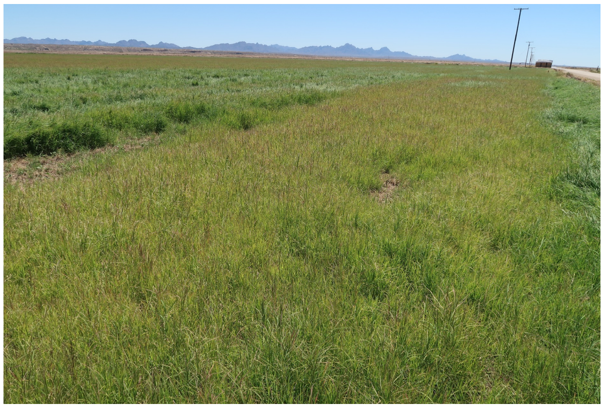

Fig. 7. Bermudagrass field exhibiting marked growth differences. Note taller green grass at field edge (right) and as parallel line to the field edge (left side of photo).

3) Plants which had yellow leaf coloration also had fungal diseases noted (Figs. 8-9).

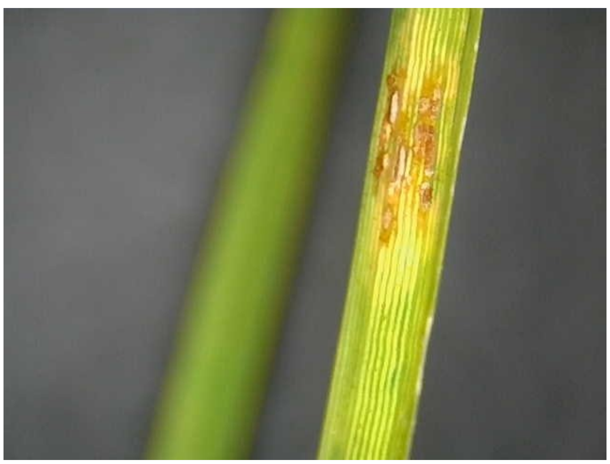

Fig. 8 Bermudagrass leaf blade with dark fungal area surrounded by yellowing. Much of leaf blade beyond this area was yellowed.

The question to be answered is: **What is/are the possible cause(s) of these symptoms?** The answer to may be one and the same.

Although soil samples were not obtained, evidence for both situations (reddening and yellowing) indicates they are related to low or inadequate levels of available fertilizer components, specifically potassium and phosphorus.

Fig. 9. Leaf blades exhibiting yellowing had dark areas on them, evidence of fungus. Leaf blade at top right was darker green and was not noted to have fungal growth.

<u>Red leaves</u>

Reddened leaves in forage grasses are not uncommon during cool spring temperatures, and are usually an indication of inadequate phosphorus availability. The classic phosphorus deficiency symptom is a reddish purple coloring of stems and leaves, usually associated with stunting or smaller non-thrifty plants, and usually occurs early in the growing season during cool, wet conditions.

There has definitely been a cool, wet start to the growing season, probably much more cool than wet considering flood irrigation is practiced here, and the cool, wet condition do not appear to have affected nitrogen uptake.

Most fields having also been laser leveled. the random patterns noted in fields do not appear to be well correlated to where the lower parts of fields which would be expected to be the coolest and wettest soil conditions.

The pH of local soils can also make phosphorus less available, as phosphorus is ‘fixed’ as insoluble calcium phosphates in soils with pH from 7.2-8.5.

When examining leaves and stems with reddened-purple colored leaves, it was noted that stems were not purple colored and leaf tips were drying and shriveling, indicating that nutrients were being translocated from older leaves to new growth. The newest 1-2 leaves on most stems that were examined did not have a reddish-purple color (Fig. 10).

Fig. 10. Bermudagrass stem showing tips of older leaves drying and reddish-purple color on newer growth. Newest growth (top left) is green and without reddish-purple color.

Lack of adequate phosphorus has been shown to limit grass hay production. While most growers know that grasses need nitrogen for growth, university research has shown that the combination of both phosphorus and nitrogen frequently increases production more than either nutrient by itself.

Yellowing/Diseased Bermudagrass

Soil fertility may also be the underlying factor contributing to the yellowing and diseased bermudagrass leaves (Figs. 7-9). Information obtained from the University of Georgia indicates that the main, non-rust bermudagrass fungal disease is caused by a fungus from the genus *Helminthosporium.*

This disease has been informally called Helminthosporium leaf spot, Helminthosporium leaf blotch, or leaf blight. (Note: The *Helminthosporium* genus has been recently been reclassified into *Cochliobolus* (anamorph *Bipolaris*) and *Pyrenophora* anamorph *Dreschlera*). *Bipolaris cynodontis* has been suggested as the probable causal agent of the disease).

University of Georgia research noted that soil potassium is critical for leaf spot resistance, as most reported leaf spot cases are directly related to low soil potassium levels.

Potassium deficiencies (perhaps better classified as induced potassium deficiency) have been noted in past years in the Palo Verde Valley in crops such as cotton, thus less than adequate available potassium level is a prime candidate as an underlying factor for the noted bermudagrass leaf spot disease.

All bermudagrass varieties respond to a good fertility program, which supplies adequate amounts of N, P and K. A soil test is the only way to determine if supplemental P or K is needed. Annual soil testing is recommended for intensively managed bermudagrass hay fields.

Unfortunately tables for phosphorus and potassium soil test results relative to bermudagrass hay production in the low desert are not readily available. The following fertilizer tables for grass production are from the University of Nebraska-Lincoln.

Please note in the following nutrient tables that Nebraska production would be expected to be less than achieved locally, thus higher application levels may be needed here. The Nebraska recommendations increased P_20_5 rates by 50% per acre and potassium rates/acre by 33% when legumes were grown in a mixed cropping with grasses (not shown on tables) due to more vegetation produced per acre. These increased rates may be more applicable locally due to our higher production/acre.

Phosphorus Soil Test Levels for Grass Hay Production			
Relative Index Value	**Method** (and ppm)		**Pounds per Acre P_2O_5 to apply**
	Bray or Mehlich II, III	Olsen	
Very Low	0-5	0-3	60
Low	6-15	4-10	40
Medium	16-25	10-17	20
High	>25	>17	0

Potassium Soil Test Levels for Grass Hay Production		
ppm K	**Relative Index Value**	**Pounds/Acre K_2O to apply**
4-40	Very Low	90
41-75	Low	60
76-124	Medium	30
125-150	High	0
>150	Very High	0

Actively growing bermudagrass removes N, P_2O_5, and K_2O in an approximate ratio of 4:1:3, thus annual nutrient replacement values for P and K can be estimated. For each 100 pounds N used, bermudagrass would remove approximately 25 pounds of P_2O_5 and 75 pounds of K_2O.

WHEAT

The wet, cool winter weather conditions have also been contributing to diseases in our local durum wheat. The majority of disease noted thus far has been caused by the bacteria *Xanthomonas campestris* pathovar (pv.) *transluscens*.

This disease actually has two different names, depending upon wheat structures being attacked. The name for this disease when it attacks leaves is bacterial leaf streak (Fig. 11), characterized by streaks that ooze yellow colored bacteria (Fig. 12).

Fig. 11. Wheat flag leaves showing yellowing/ orange colored areas from bacterial wheat streak infestation (photo courtesy of Rich Wellman).

The dried bacteria ooze results in a scale-like appearance on leaves, but as dried, yellowed exudate clumps on wheat peduncles (stem area between head and top (flag) leaf) (Fig. 13).

Fig. 12. Yellow-colored bacterial exudates that ooze from infected wheat plants are indicative of the bacterial disease Xanthomonas campestris.

Fig. 13. Wheat peduncle with dried Xanthomonas bacterial exudates. Affected areas are also often slightly mis-shapen and curved.

When *Xanthomonas* moves up and affects the head and glumes, the disease is known as black chaff as the glumes turn a dark color. Bands of necrotic and healthy tissue on awns, resulting in what is referenced as a 'barber' pole appearance, is indicative of black chaff.

Local PCAs have been finding heads that are yellowing (Fig. 14), prior to the finding dis-colored awns, with this being almost always associated with an infected peduncle.

Fig. 14. Yellowed awns are usually found locally on wheat plants with peduncles that are infected with Xanthomonas prior to black chaff development on awns and glumes (photo courtesy of Richard Wellman).

While there are other diseases and some genetic factors that can cause wheat glumes to darken, black chaff can be distinguished from other diseases by the appearance of cream to yellow bacterial ooze produced on infected plant parts during wet or humid weather as well as the "barber's pole" appearance of awns.

Being a bacterial disease rather than a fungal disease, fungicides are ineffective in providing control of *Xanthomonas*. Registered bactericides are not systemic, thus control of this disease once inside the wheat plant cannot currently be achieved by bactericides.

The primary source of inoculum for long distance spread of this disease is through contaminated seed. Secondary source of inoculum is through the exudates and populations on volunteer cereals and grassy plants. Short distance spread is through splashing water, plant-to-plant contact, and insects.

During the growing season it is capable of living on the plant surface without causing any symptoms. Cool and moist conditions allow *Xanthomonas* to proliferate. It enters plants through their stomata and through wounds.

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All photos are those of author other than stated exceptions.

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