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In this June issue of the Postings from the Palo Verde;

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Regards:

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The Effects of Short-term Fallowing on Soil Quality and Crop Growth

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Many Southwestern states, including California and Arizona, are adjusting to the possibility of Colorado River water shortages as reduced supplies are projected in the coming decades. One strategy that has been employed to balance water demand throughout the region is the transfer of water from agricultural areas in parts of the desert Southwest to urban areas.

Agriculture to urban water transfer normally involve a method of water conservation such as fallowing or idling land, shifting to crops that consume less water, or utilization of groundwater pumping for irrigation. Many transfers across the West incorporate several years of land fallowing as the central component of such agreements. These large-scale, long-term water transfers have the potential to impart significant changes to regional soil quality and crop production. Studies have shown that land fallowing is beneficial to soil quality, crop production and overall long-term sustainability, as continued soil cultivation radically alters soil structure, chemistry, and biology. Therefore, land fallowing associated with ag-to-urban water transfers may be thought of as a sustainable land management practice that can be employed to reverse some of the negative effects of continued soil cultivation.

The recently completed Palo Verde Irrigation District - Metropolitan Water District crop rotation and water supply program included fallowing a large percentage of land within the Palo Verde Valley each year as part of the agreement between the two agencies. The effects of short-term fallowing on soil quality and crop growth following the completion of the water transfer had not been studied in the region until recently. A study conducted by graduate student Jeremy Cusimano from the University of Arizona aimed to quantify the effects of short-term fallowing on soil quality and agricultural productivity within the Palo Verde Valley. Working with local growers, Dr. Vonny Barlow of the University of California Cooperative Extension in Blythe, and the Palo Verde Irrigation District, the research project compared differences in soil fertility, microbial communities, and crop growth and development between fallowed sites and arable sites throughout the Palo Verde Valley.

Composite pre-season soil samples were taken from numerous fallow and arable fields throughout the Valley. Half of field sampled had been fallow for ≈ 18 months, while the other half of field had been previously planted with spring melons. Soil samples were analyzed for available N-P-K, salt content, and soil organic matter (SOM), and were also used for microbiological analysis. The same fields were then planted in the fall with broccoli, which was used to compare the effects of fallowing on plant growth rate, biomass accumulation, and marketable yield.

The study found that short-term fallowing had increased the quantity of sequestered carbon, or soil organic matter, and nitrate, which has beneficial effects on soil quality and crop production. However, it was also found that fallowing increased salt concentration by approximately 35% in PVID soils, which needs to be managed properly for normal crop growth and production. The project also revealed that microbial communities had significantly benefitted from fallowing. Higher microbial activity and greater microbial diversity was observed in soil samples from fallow fields. This leads to increased nutrient cycling in soils, which benefits crop production.

The study also found that improvements in soil quality associated with fallowing had benefitted crop growth and production of a short-term fall broccoli crop. Marketable yield, total plant biomass and growth rate were all significantly higher after fallowing. These fields produced on average an additional 30 cartons of broccoli per acre than fields that had been continuously farmed.

It can be inferred from the study that the PVID-MET water transfer has been beneficial to soil quality within the Palo Verde Irrigation District. However, the beneficial effects of fallowing on subsequent nutrient dynamics, microbial communities and crop growth may be mostly short-lived, and possibly masked by grower management decisions. It is important that area growers understand the effects of fallowing on subsequent nutrient dynamics, and routine soil sampling should follow any fallow period. Observed changes in soil properties may require growers to change management strategies such as irrigation timing and frequency, and fertilizer applications. The knowledge obtained in the study provides a foundation for further research concerning water transfers and their implications on soil quality and crop growth. More research is needed in the Palo Verde Valley to understand the effects of fallowing on more highly valued agronomic crops such as alfalfa and cotton.

Blue alfalfa aphid issue summary

Of all of the insecticides evaluated against Blue alfalfa aphid (BAA) by E. Natwick of Imperial County almost every insecticide applied to alfalfa this spring gave initial knockdown of BAA. Blue alfalfa aphid populations resurged in 7-10 days. Treatments giving 70 – 75 % control (reported by PCA's) were combinations of a pyrethroid with an organophosphate.

Possible factors for our BAA issue;

- ✓ High initial aphid populations
- ✓ Smaller than expected populations of predators and parasites; particularly the seven-spotted lady beetle
    - o May be weather related or pesticide relate

- ✓ Potentially more insecticides to alfalfa than in the past; partially due to cowpea aphid
- ✓ Lack of "bio-rational" for weevil and aphid management in alfalfa
    - o Growers are spraying at the time of year when there are the fewest beneficial insects in alfalfa. The insecticides along with cool weather may be preventing or delaying the buildup of beneficial insect populations

Blue Alfalfa Aphids per Sweep, Holtville, CA, 2013.

Treatment	fl oz/acre	1DPT[w]	3 DAT[xz]	7 DAT	10 DAT	14 DAT	PTA[yz]
Check	--------	105.05 a	58.58 a	38.83 a	82.50 a	39.10 b	54.75
Warrior II	1.92	127.80 a	10.95 bc	8.63 c	15.55 b	24.23 bc	14.84 b
Endigo ZCX	4.0	84.00 a	1.08 f	3.05 c	4.48 b	13.73 c	5.58 bc
Besiege	9.0	103.05 a	5.55 cd	2.93 c	16.63 b	21.60 bc	11.68 b
Cobalt Advanced	24.0	69.75 a	2.23 de	1.60 c	5.73 b	6.60 c	4.11 c
Mustang	4.3	91.48 a	4.53 d	3.20 c	13.13 b	18.13 bc	9.74 b
Stallion 3.025 EC	9.25	95.98 a	3.53 d	2.38 c	14.33 b	13.45 c	8.42 bc
Stallion 3.025 EC	11.75	105.05 a	2.08 ef	2.25 c	5.48 b	22.45 bc	8.06 bc
Danitol	16.0	115.23 a	13.98 b	22.28 b	65.45 a	65.45 a	41.79 a

Blue Alfalfa Aphids per Ten Sweeps, Holtville, CA, 2013.

Treatment	fl oz/acre	PT[w]	3 DAT[x]	7 DAT[z]	14 DAT	PTA[yz]
Check	--------	58.48 a	65.66 a	82.64 a	86.36 a	78.22 a
Paradigm VC	3.84	60.02 a	17.12 b	18.68 b	20.16 b	18.65 b
Baythroid XL	1.9	49.58 a	11.84 b	23.20 b	26.12 b	20.39 b
Mustang	4.3	54.44 a	11.42 b	15.40 b	23.00 b	16.61 b
Lorsban Advanced	24.0	81.56 a	8.20 b	7.28 c	15.34 b	10.27 c
Warrior II	1.92	72.64 a	14.58 b	6.94 c	15.92 b	12.48 bc

Means within columns followed by the same letter are not significantly different, LSD; *P*= 0.05.

[w] Pre-treatment

[x] Days after treatment.

[y] Post treatment average.

[z] Log_{10} (X+1) transformed data used for analysis, ACTUAL MEANS REPORTED.

Dodder

Dodder is an annual, parasitic flowering plant, widely distributed throughout the world. It is the most destructive weed in many alfalfa seed fields in the western United States and, where uncontrolled, has ended profitable production of alfalfa seed. Dodder reduces alfalfa growth, vigor, and stand life. Dodder seed can remain dormant in the soil for 30 years, because the seed coat is relatively impermeable to oxygen.

Symptoms

The first signs of the parasite are fine, inconspicuous, orange to yellow, leafless seedlings that emerge from seed in or on the soil. Seedlings attach to the host plant and produce abundant fine, orange to yellow strands that grow and entwine the aboveground parts of the plants. Dodder has small, white flowers and tiny scales instead of leaves. The mass of entwined stems from a single plant may spread to a diameter of 9 m or more. Heavily infected alfalfa plants are weakened, are matted down, and decline in vigor. Infested areas gradually assume the yellowish color of the parasitic vine. Dodder, if harvested with alfalfa, increases the drying time, or can result in wet spots in the baled hay, resulting in moldy hay. Dodder is also a problem in alfalfa grown for seed. Dodder has a rougher seed coat than alfalfa seed and thus can be removed from alfalfa seed, but dodder removal is seldom completely effective and some good alfalfa seed is lost in the cleaning process.

Causal Organism

Three *Cuscuta* spp. commonly occur on alfalfa: *C. indecora* Choisy (large-seed dodder) is common in the western United States but rare in the east; *C. approximata* Bab. (small-seed dodder) is severe in the west but absent in the east; and *C. pentagona* Englm. (field dodder), the most damaging to alfalfa, has a wide host range and occurs in most parts of the United States.

Cuscuta spp. belong to the family Convolvulaceae (Cuscutaceae in some taxonomic keys). Some species have a small amount of chlorophyll but cannot support themselves and must live as parasites. Dodder is favored by high temperature and full sunlight.

Disease Cycle and Epidemiology

The dodder plant reproduces from seed. Dodder seeds germinate independently of the presence of host plants. Favorable soil temperatures for dodder germination and emergence are in the range of 15 to 38°C, with an optimum around 30°C, which corresponds with the prevailing temperatures during the spring and summer. Because of the seed size (1 to 2 mm in diameter), emergence is limited to the upper 1 to 1.5 cm of soil. The rootless dodder seedling emerges from the soil as a slender yellow stem that rotates slowly in a counter-clockwise direction. The dodder seedling coils around the host stem, penetrates its tissue and vascular system via haustoria, and exploits the host by withdrawing photosynthates and water. The base of the dodder seedling then withers and dies, losing contact with the soil and living completely at the expense of the host. A dodder seedling dies within 10 days if a host is not contacted.

Dodder grows rapidly and produces many entwining stems that reach out to attach to adjacent plants. During the growing season, clusters of small, mostly white flowers produce abundant seed. The seeds fall to the ground or are harvested with the alfalfa hay or seed. The seeds are similar in size to those of alfalfa but the seed coats are rougher.

Dodder is spread with alfalfa seed, in hay, by farm workers and implements, in irrigation and surface drainage water, and in manure from animals fed contaminated hay. Dicotyledonous weeds and many horticultural plants, such as tomato or onion and garlic are hosts and can be sources of infestation. Grasses and sedges are not hosts.

Control

Fallowing or crop rotation can be used to reduce the amount of dodder seed in a field, but because dodder seed survive in the soil for many years, these methods are seldom completely effective. Additionally, weeds in a fallow field or non-host crop field can act as hosts for dodder and must be destroyed prior to seed production. Preventing dodder seed introduction is the best control. Use certified seed free of dodder. Small-seed dodder can be removed from alfalfa seed by screening. A magnetic seed separator is sometimes used to separate large-seed dodder by use of fine iron powder, which clings to the rough-coated dodder seed. Flannel rollers can be used to pick up dodder seed.

When dodder occurs in patches, destroy all dodder and the host by flaming or by cutting alfalfa below the point of dodder attachment and burning the residue. The spots must be treated consistently until all host and dodder plants are destroyed. Cutting alfalfa at ground level slows regrowth, but is generally less injurious to alfalfa than flaming. Preventing dodder seed production is critical to long-term management.

Chemical control of dodder in alfalfa is complex. Trifluralin or pendimethalin are effective against dodder when applied prior to dodder emergence. Trifluralin granules or pendimethalin spray are applied to the soil surface and rainfall or irrigation are used for incorporation. Maintaining these herbicides near the soil surface is critical to their success, since dodder seed germinates at or very near the soil surface. Generally, these herbicides will last for 60 to 90 days and a second application is needed to provide full season control. Glyphosate can be used to control attached dodder in Roundup Ready alfalfa. Glyphosate is most effective when applied soon after dodder attachment. Large patches will require repeat treatments, and repeat treatments will likely be needed to control newly emerging dodder, since glyphosate does not have residual activity. Imazethapyr is partially effective in controlling emerging and newly attached dodder in seedling alfalfa.

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(Prepared by W. T. Lanini)