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THE RELATIONSHIP OF SOIL COMPOSITION TO THE PHYSICAL CONDITION OF THE SOIL

Herman Meister

A soils physical condition is important to its ability to produce crops. A soil in poor physical condition usually has reduced water infiltration and aeration. These characteristics reduce the ability of the soil to supply nutrients to plants by limiting root growth. Small changes in a soil's physical condition can have a large impact on these essential processes. Creating a good physical environment is critical to building and maintaining a healthy soil.

Soil Composition

The physical composition of a soil usually contains about 50% solid particles and 50% pore spaces on volume basis. The solid portion is composed of a mixture of minerals of various sizes ranging from fine-grained microscopic clays to easily visible large sand grains. The relative amounts of the various particle sizes defines the texture of a soil, such as clay, clay loam, loam, sandy loam, or sand.

The sizes of the pore spaces between the particles and between aggregates are much more important the sizes of the particles themselves. The total amount of pore space and the relative quantity of various sizes of pores (large, medium, small, and very small) govern water movement and the soils ability for sustaining soil organisms and plants. Pore space is important because that is where all the important processes such as water and air movement occur along with root growth and nutritional functions. Soil composition and texture does not change over time, but the total amount of pore space and the relative amount of pore spaces are strongly affected by management practices.

Water and Aeration

The soil pore spaces can be filled with either air or water, and their relative amounts change as the soil wets and dries. When all the pores are filled with water, the soil is *saturated* and the soil gases cannot exchange with the atmospheric gases. This means that carbon dioxide from respiring roots cannot escape from the soil and oxygen cannot enter which leads to an undesirable *anaerobic* condition (no oxygen). The other extreme is where a soil with little water will have good gaseous exchange, but cannot supply sufficient water for plants and soil organisms.

Coarse sandy soils have very small amounts of water available to plants before they reach their wilting point. Fine-textures soils like clay-loams have many small pores, which hold on tightly to water. In this case, clay soils will have long periods of poor aeration, but more plant-available water over a longer period of time.

The ideal soil is somewhere between the two extremes of a "clay" and a "sand". This medium textured well-aggregated loam soil has enough large pore spaces between the aggregates to provide adequate drainage and aeration during wet periods, but also has adequate small pores and water holding capacity to provide sufficient water to plants and soil organisms between irrigations. Besides holding and releasing water well, such soils also allow for good water infiltration, root growth and nutrition.

The various soil types in the Imperial Valley and estimated acreage are shown in Table 3, an excerpt from the "Soil Survey of Imperial County, California", a USDA Soil Service Publication in cooperation with UC Agricultural Experiment Stations.

The soil series 129 through 141 listed in Table 3 are found along the East and West Mesa of Imperial County and along the Salton Sea. They are used mostly for desert recreation. Imperial silty clay and Imperial-Glenbar silty clay loams (114 & 115) comprise approximately 75 % of the agriculture land farmed in the Valley.

TABLE 3. – ACREAGE AND PROPORTIONATE EXTEND TO THE SOILS

Map symbol	Soil Name	Acres	Percent
100	Antho loamy fine sand	4,134	0.4
101	Antho-Superstition complex	8,416	0.9
102	Badland	4,390	0.4
103	Carsitas gravelly sand, 0 to 5 percent slopes	7,011	0.7
104	Fluvaquents, saline	12,262	1.2
105	Glenbar clay loam	2,951	0.3
106	Glenbar clay loam, wet	4,239	0.4
107	Glenbar complex	12,894	1.3
108	Holtville loam	2,804	0.3
109	Holtville silty	3,628	0.4
110	Holtville silty clay, wet	70,547	7.1
111	Holtville-Imperial silty clay loams	2,242	0.2
112	Imperial silty clay	1,405	0.1
113	Imperial silty clay, saline	5,679	0.6
114	Imperial silty clay, wet	123,401	12.5
115	Imperial-Glenbar silty clay loams, wet, 0 to 2 percent slopes	203,659	20.6
116	Imperial-Glenbar silty clay loams 2 to 5 percent slopes	2,162	0.2
117	Indio loam	9,169	0.9
118	Indio loam, wet	13,625	1.4
119	Indio-Vint complex	29,643	3.0
120	Laveen loam	2,322	0.2
121	Meloland fine sand	10,748	1.1
122	Meloland very fine sandy loam, wet	41,734	4.2
123	Meloland and Holtville loams, wet	11,483	1.2
124	Niland gravelly sand	7,884	0.8
125	Niland gravelly sand, wet	9,820	1.0
126	Niland fine sand	2,846	0.3
127	Niland loamy fine sand	2,088	0.2
128	Niland-Imperial complex, wet	6,974	0.7
129	Pits	1,400	0.1
130	Rositas sand, 0 to 2 percent slopes	22,608	2.3
131	Rositas sand, 2 to 5 percent slopes	1,590	0.2
132	Rositas fine sand, 0 to 2 percent slopes	77,301	7.8
133	Rositas fine sand, 2 to 9 percent slopes	40,748	4.1
134	Rositas fine sand, 9 to 30 percent slopes	19,401	2.0
135	Rositas fine sand, wet, 0 to 2 percent slopes	22,626	2.3
136	Rositas loamy fine sand, 0 to 2 percent slopes	90,896	9.2
137	Rositas silt loam, 0 to 2 percent slopes	3,737	.04
138	Rositas-Superstition loamy fine sands	11,373	1.2
139	Superstition loamy fine sand	12,887	1.3
140	Torriorthents-Rock outcrop complex, 5 to 60 percent slopes	462	*
141	Torriorthents and Orthids, 5 to 30 percent slopes	900	0.1
142	Vint loamy very fine sand, wet	31,545	3.2
143	Vint fine sandy loams	13,066	1.3
144	Vint and Indio very fine sandy loams, wet	15,462	1.6
	Water	3,288	0.3
	Total	989,450	100.0

* Less than 0.1 percent

APHIDS IN CARROTS

Eric T. Natwick

APHIDS

There are several species of aphids that are pests of carrots in Imperial Valley, CA. All parts of the carrot plant may become infested with one or more of these aphid species. Aphid populations do not often reach economically damaging levels in carrot fields. However, when insecticide treatments are necessary organophosphate insecticides have been most frequently chosen for control of these pests.

A variety of common predators and parasites attack aphids in carrots. Lady beetles, green lacewing larvae, and syrphid fly larvae are frequently found associated with aphid colonies. The presence of these predators and their impact on aphid populations should be noted during routine monitoring. Aphids are also attacked by a number of very prolific parasitic wasps, such as *Lysiphlebus testaceipes*. Parasitized aphids become swollen and their bodies turn tan in color. Entomopathogenic fungi such as *Beauvaria bassiana* and *Paecilomyces fumosoroseus* also attacked aphids. Diseased aphids appear flattened, may appear fuzzy and the aphid bodies appear to be glued to the leaf.

Green peach aphid, *Myzus persicae*

Green peach aphid is commonly found in carrots in the low and desert valleys during the winter and spring. Green peach aphid is a medium-sized aphid. The wingless forms are often uniformly pale green in color, but at times, yellow, pinkish or red forms may be present. During cool weather, individuals of all color forms may be slightly darker than those found during hotter times of the year. The red morphological type of green peach aphid is more tolerant to organophosphate, pyrethroid and endosulfan insecticides, but the green type is more susceptible to these insecticides. Green peach aphids prefer to start colonizing older leaves first, but rapidly developing colonies will colonize the entire above grounds portions of the carrot plant. If populations are high enough, stunting may occur. Infestations on young plants are more serious than those on older plants. Green peach aphid transmits over 100 different virus diseases, more plant viruses than any other aphid, some of which affect carrots.

Small colonies of green peach aphid occasionally develop on carrot leaves and may build to economically damaging levels, but treatment thresholds have not been established on carrots. Some populations of green peach aphid are highly resistance to insecticides. Currently, there are no highly efficacious alternatives to organophosphate insecticides registered for green peach aphid control on carrots in California. Therefore, insecticides must be applied early and often, but frequent insecticide application is not always effective in preventing establishment of green peach aphid. When green peach aphid control is successful in carrots, it is often not cost effective.

Field sanitation is an important cultural practice for reducing the number of aphids in and around carrots. Green peach aphid is attacked by a number of common predators and parasites and is susceptible to the fungus disease that commonly attacks aphids. Common predators include green lacewing, lady beetles, and syrphid fly larvae. However, buildup of predator, parasite, or pathogens rarely occurs prior to economic damage has occurred due to green peach feeding.

Bean Aphid, *Aphis fabae*

Bean aphid is dark olive green to black in color and is easily confused with cowpea aphid. The dorsal abdomen of the adult bean aphid has a dull appearance while the cowpea aphid adult has a shiny dorsal abdomen. The cauda (tail-like structure) of the bean aphid has more hairs than that of the cowpea aphid and thus appears bushy. Little is known regarding bean aphid damage as it only occasionally builds up on carrots. Bean aphid prefers sugar beets to carrots in the Imperial Valley.

No thresholds have been established for the treatment of bean aphid on carrots. Bean aphid rarely causes economic damage so treatment is rarely required and insecticides treatments do not prevent virus transmission.

No cultural control strategies are presently available for managing bean aphids in carrots. A variety of common aphid predators and parasites attacked bean aphids. Lady beetles, green lacewing larvae, and syrphid fly larvae are frequently found associated with aphid colonies. The presence of these predators and their impact on aphid populations should be noted during routine monitoring. A prolific parasitic wasp, *Lysiphlebus testaceipes*, attacks Bean aphid. Parasitized aphids become swollen and their bodies turn tan in color. Bean aphid is also attacked by a fungus disease that leaves the aphid body flattened and with the appearance of being glued to the leaf.

Cotton/Melon Aphid, *Aphis gossypii*
Cotton/melon aphid is a small to medium-sized aphid. It is highly variable in color, ranging from lemon yellow to blackish green in different individuals, often within the same colony. The aphid is commonly lighter in color during the hotter times of the year and darker during cooler periods, but both color forms may be found throughout the year.

Cotton/melon aphid is known to transmit more than 50 viruses, some of which affect carrots. It does not generally build up large populations on carrots but may occasionally cause some feeding injury. Leaves with feeding injury appear curled and distorted. If populations are large enough, sooty mold may be produced.

Carrots planted adjacent to infested cotton or melons are at risk of becoming infested with this aphid particularly in fall following cotton defoliation or termination of the melon crop. Carrots should be planted a safe distance from both, if possible. Cotton/melon aphid is rarely found on carrots in the deserts. This aphid pest was prevalent on melons in the deserts until pre-plant treatments with imidacloprid were implemented for whitefly control during the mid-1990's. The cotton/melon aphid point sources for infestation of carrots have been reduced in the Imperial Valley. Cotton/melon aphid has not been a problem on the deserts cotton and is rarely seen on melons.

Common aphid predators attacked cotton/melon aphid, e.g. green lacewing, lady beetles, and syrphid fly larvae. Several parasites of this aphid are present in California and can provide effective control. Parasitized aphids are identified by their tan color and swollen appearance. Cotton/melon aphid rarely causes economic damage so treatment is rarely required and insecticides treatments do not prevent virus transmission.

Crown and Root Aphids
There are several species of aphids that attack the crown and roots of carrots: *Dysaphis foeniculus* and *D. apiifolia* (Hawthorn/parsley aphids); *D. tulipae* (Tulip bulb aphid); *D. crataegi* (Hawthorn carrot aphid). These aphids form colonies near the top of the root and at the base of the stems. They occasionally form colonies on the root slightly below ground. All are similar in appearance. The wingless forms are pale yellow to gray green in color and covered with a powdery wax. The tulip bulb aphid is covered with a white waxy powder while the wax covering the hawthorn parsley aphid is grayish white. The hawthorn carrot aphid is yellowish gray to greenish gray with a very light dusting of wax. Ants tend all three of these aphid species, so the presence of ants around the base of the plants is usually a good clue to the presence of these aphids.

Crown and root aphid infestations infrequently cause economically important injury as colonies are locally clustered in a few small pockets of carrot fields. Imperial Valley carrot fields have occasionally been abandoned due to numerous crown and root aphid colonies that reduce the ability of mechanical carrot diggers to grasp and pull the carrots from the soil. High populations of crown and root aphids stunt growth, but more serious is that the tops may be weakened by their feeding and break off during harvest, leaving the carrot in the ground. Non-systemic insecticides have limited utility in treating the crown and root aphids. It is difficult to penetrate the carrot crop canopy to saturate the crown with insecticides and nearly impossible to treat the roots of the carrot crop with a post emergence foliar spray.

Sanitation and crop rotation to non-host crops is important in reducing the buildup of crown and root aphids and their injury. Because of their location near and below the soil line, predators and parasites have a difficult time finding these aphids. The attendance by ants also discourages the activity of predators and parasites.

MOVING VIOLATIONS WITH FARM EQUIPMENT CAN BE COSTLY

Keith S. Mayberry

Officer Jose Salazar of the California Highway Patrol works on the Safety and Farm Labor Vehicle Education program. We drove around Imperial

Valley so that he could view some field harvesting and labor intensive cultural operations.
We spotted a number of pieces of equipment at the edge of a field, so we stopped to discuss the use of the equipment in agriculture. One implement was a planter sled, which was connected to a tractor. The tractor had a “slow moving vehicle” sign on it; the planter did not. I asked Officer Salazar if this planter rig was legal to drive down the highway.

Officer Salazar looked over the safety features and said “No, the housing on the vacuum blower on the planter sled is blocking the view of the slow moving vehicle sign on the tractor”. He said the farmer would need to put a second slow moving vehicle sign on the planter sled to be legal.

I asked “What size sign? Where does it need to be mounted?”

The Officer said the laws from this equipment are spelled out in the California Vehicle Code book that any farmer may buy for a small sum of $3 (three) dollars from the Department of Motor Vehicles. It would be good for every farming company to get one and brush up on the law to prevent accidents, loss of life and potential lawsuits.

When we got back to my office, I quickly found that the California Vehicle Code is posted on the Internet as well. You can find it for free at http://www.leginfo.ca.gov/calaw.html along with the other 28 codes for California Law.

The section on slow moving emblems states, “24615. It is unlawful to operate upon a public highway any vehicle or combination of vehicles, which is designed to be and is operated at a speed of 25 miles per hour or less, unless the rearmost vehicle displays a "slow-moving vehicle emblem," except upon vehicles used by a utility, whether publicly or privately owned, for the construction, maintenance, or repair of its own facilities or upon vehicles used by highway authorities or bridge or highway districts in highway maintenance, inspection, survey, or construction work, while such vehicle is engaged in work at the jobsite upon a highway. Any other vehicle or combination of vehicles, when operated at a speed of 25 miles per hour or less, may display such emblem. The emblem shall be mounted on the rear of the vehicle, base down, and at a height of not less than three nor more than five feet from ground to base. Such emblem shall consist of a truncated equilateral triangle having a minimum height of 14 inches with a red reflective border not less than 13/4 inches in width and a fluorescent orange center.”

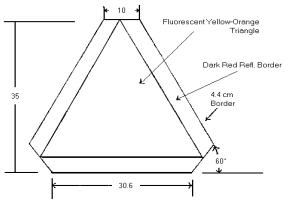
When I asked Officer Salazar about sprinkler pipe trailers and where one would put a “slow moving vehicle” sign, he said that during the daylight hours flags could be used instead of the emblem. The section of code governing flags is quoted below.

“36509. (a) An implement of husbandry, a farm vehicle, or any vehicle escorting or towing an implement of husbandry or farm vehicle, may display flashing amber warning lamps or flashing amber turn signals:

(1) When the vehicle is required to display a "slow moving vehicle" emblem as defined in Section 24615.

(2) When the width, length, height, or speed of the vehicle may cause a hazard to other traffic on the highway.
(b) An implement of husbandry, a farm vehicle, or any vehicle towing an implement of husbandry or farm vehicle, when the load upon the vehicle exceeds 120 inches in width, shall display either:
(1) Flashing amber warning lamps.
(2) Flashing amber turn signals.
(3) During daylight hours, red flags, each of which shall be not less than 16 inches square, mounted at the left and right outer extremities of the vehicle or load whichever has the greater
horizontal dimension.”

There is a lot of very useful information found in the code book. I recommend that every farming company get a code book and that the company safety officer ensure that their equipment is in compliance with the law.



COMPARISON OF FUNGICIDES FOR CONTROL OF POWDERY MILDEW ON LETTUCE, 2001

Thomas A. Turini

The activity of several fungicides for lettuce powdery mildew control were compared in experiments conducted at Desert Research and Extension Center in Holtville, CA. On 20 November, 2001, "Coyote" (Syngenta) iceberg lettuce seed was sown and irrigated.

The treatments evaluated are listed in Table 1. Materials were applied in the equivalent of 30 gallons of water per acre with a CO_2 pressurized backpack sprayer at 30 psi. A 3-nozzle hand-held spray boom was used with Teejet 8002 flat fan nozzles spaced 10-inch apart.

Powdery mildew severity was rated according to the following scale: 1 = no powdery mildew observed; 2 = powdery mildew on lower wrapper leaves only; 3 = powdery mildew on upper wrapper leaves; 4 = powdery mildew on cap leaf or upper leaves in romaine or leaf lettuce; 5 = extensive powdery mildew on the entire plant. Ten plants within each plot were evaluated and mean severity rating was derived for each plot.

The experimental design was a randomized complete block with five replications. Plot dimensions were 2 beds by 25 feet. An analysis of variance was preformed and LSD (P = 0.05) is presented.

Materials were applied on 18 March and 1 April, 2002. When the first application was made, no powdery mildew symptoms were detected. Disease severity was evaluated on 5 April.

RESULTS//DISCUSSION

Quintec alternated with Rally, Microthiol Special, Flint and Quintec provided excellent control of powdery mildew. BAS 516 and BAS 500 provided better control than most treatments but had significantly higher disease severity and incidence than the best performing materials. KP481, Quadris, Curzate with or without Maneb, and Actigard alternated with Quadris provided intermediate levels of control. Disease incidence and severity of disease in plants treated with Maneb, Zoxium with Maneb and Serenade were not different than the untreated control (Table 1).

Of the materials tested, Microthiol Special (sulfur) and Quadris are registered for use on lettuce.

Table 1. Fungicide activity against powdery on iceberg lettuce at Holtville, CA

Treatment [y]	Rate (fp/acre)	Severity rating[z]	Affected plants (%)
Untreated	----	3.7	100
Quintec alternated with Rally 40W	6.0 fl oz + 0.1 lb	1.2	34
Microthiol Special	6.0 lbs	1.4	38
Flint	1.5 oz	1.4	36
Quintec	6.0 fl oz	1.5	48
BAS 516	1.45 lbs	2.4	76
BAS 500	16.0 oz	2.6	88
BAS 500	12.0 oz	2.9	94
DPX-KP481 50WG	8.0 oz	2.9	94
Quadris	15.4 fl oz	2.9	92
Curzate 60DF	5.0 oz	3.0	98
DPX-KP481 50WG	12.0 oz	3.1	84
Zoxium	0.2 lb	3.1	94
Curzate 60DF + Maneb 75DF	6.0 oz + 1.5 lb	3.2	100
Curzate 60DF + Maneb 75DF	6.0 oz + 2.0 lb	3.2	94
Actigard alternated with Quadris	1.0 oz / 15.4 fl oz	3.2	96
Maneb 75DF	2.0 lb	3.3	100
Zoxium + Maneb 75DF	0.2 lb + 2.0 lb	3.3	100
Serenade	6.0 lbs	3.5	100
LSD (P = 0.05)		0.5	22

[y] All materials were applied 4 times unless (2x) appears right of the material, which indicates that the material was applied twice.

[z] On twenty plants, disease severity was rated according to the following scale: 1 = no powdery mildew observed; 2 = powdery mildew on lower wrapper leaves only; 3 = powdery mildew on upper wrapper leaves; 4 = powdery mildew on cap leaf or upper leaves in romaine or leaf lettuce; 5 = extensive powdery mildew on the entire plant.

ESTIMATING SOIL MOISTURE LEVEL BY THE FEEL METHOD

Khaled M. Bali

Determining soil moisture content is the most important step in irrigation scheduling. There are several methods for estimating soil moisture content. These methods vary widely in their accuracy. The simplest and the oldest is the "feel method". The only equipment needed for this method is a soil auger or shovel. The accuracy of this method depends mainly on the experience of the person who is evaluating the soil moisture level.

Soil scientists have developed standard techniques to determine the percent of available water based on the feel method. The table below classifies soil water levels into six categories ranging from above field capacity to permanent wilting point. The field capacity is the upper limit of soil water holding capacity. The permanent wilting point is the lower limit of soil water content below which plants cannot extract water and become permanently damaged. The available water is the amount of water held between the two limits. As a rule of thumb, field capacity is the amount of water in the soil profile 3 to 5 days after an irrigation event. Both field capacity and permanent wilting point depend on several factors such as soil type, crop type, and growth stage. Therefore, the percent of available water varies widely during the season.

Guide for estimating soil moisture available for plant use

Dominant Texture	**Fine Sand and Loamy Fine Sand**	**Sandy Loam and Fine Sandy Loam**	**Sandy Clay Loam and Loam**	**Clay, Clay Loam, or silty Clay Loam**
Available Water Capacity (inches/foot)	**0.6-1.2**	**1.3-1.7**	**1.5-2.1**	**1.6-2.4**
Available Soil Moisture (%field Capacity) 0-25	Appears dry, will hold together if not disturbed, loose sand grains on fingers	Appears dry, form a very weak ball, aggregated soil grains break away easily from ball	Appears dry, soil aggregations break away easily, no moist soil stains on fingers, clods crumble with applied pressure	Appears dry, soil aggregations separate easily, clods are hard to crumble with applied pressure
25-50	Slightly moist, forms a very weak ball with well-defined fingers marks, light coating of loose and aggregated sand grains remain on fingers	Slightly moist, forms a weak ball with defined finger marks, darkened color, no water staining on fingers	Slightly moist, forms a weak ball with rough surfaces, no water staining on fingers, few aggregated soil grains break away	Slightly moist, forms a weak ball, very few soil aggregations break away, no water stains, clods flatten with applied pressure
50-75	Moist, forms a weak ball with loose and aggregated sand grains on fingers, darkened color, light uneven water staining on fingers	Moist, forms a ball with defined finger marks, very light soil/water staining on fingers, darkened color, will not slick	Moist, forms a ball, very light water staining on fingers, darkened color, pliable, forms a weak ribbon	Moist, forms a smooth ball with defined finger marks, light soil/water staining on fingers, ribbons between thumb and forefinger
75-100	Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon	Wet, forms a ball with wet outline left on hand, light to medium water staining on fingers, makes a weak ribbon	Wet, forms a ball with well-defined finger marks, light to heavy soil/water coating on fingers, ribbons between thumb and forefinger	Wet, forms a ball, uneven medium to heavy soil/water coating on finger, forms ribbons easily
100 (At field crop)	Wet, forms a weak ball, light to heavy soil/water coating on fingers, wet outline of soft ball remains on hand	Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, medium to heavy soil/water coating on fingers	Wet, forms a soft ball, free water appears briefly on soil surface after squeezing or shaking, thick soil/water coating on finger	Wet, forms a soft ball, free water appears on soil after squeezing or shaking, thick soil/water coating on fingers, slick and sticky

Source: Adapted from USDA-NRCS- Estimating soil moisture by feel and appearance

LAMBS REDUCE INSECT PRESSURE IN WINTER ALFALFA

Juan N. Guerrero and Eric T. Natwick

A lamb grazing trial was conducted at the University of California Desert Research and Extension Center during the winters of 2001 and 2002. Only 2001 data will be reported at this time. The objective of this 2-year study was to evaluate the effectiveness of grazing lambs for insect control in winter alfalfa. The insect species that were of most concern were Egyptian alfalfa weevil (*Hypera brunneipennis,*) EAW, cow pea aphid (*Aphis craccivora* Koch), pea aphid (*Acyrthosiphon pisum*), the blue alfalfa aphid (*Acyrthisiphon kondoi*), and the spotted alfalfa aphid (*Therioaphis maculate*).

On December 8, 2000 we received 16 wethers, mean weight 108 lb. We compared lamb grazing to a no-grazing control, and to two insecticides; Furadan® and Lorsban®; for insect control in winter alfalfa. Insecticides were applied according to University of California Integrated Pest Management Guidelines. Four wethers, randomly allocated by weight to experimental paddocks, grazed alfalfa paddocks, 66 x 66 ft., for 10 to 14 days. Each treatment was replicated four times. Esophageal cannulas were placed in four wethers to detect the presence of insects in extrusa (extrusa is consumed alfalfa extracted from the fistula). Immediately after grazing, extrusa was examined to detect the presence of insects in consumed alfalfa. Extrusa data were reported as number of insects, or insect parts, per gm of extrusa DM. At the first alfalfa hay harvest after the cessation of lamb grazing, five 0.1 m^2 quadrats of alfalfa forage on each experimental paddock were clipped at a one inch height and dried in a forced-air oven for 72 h at 122˚ and weighed. After being weighed, each alfalfa quadrat sample was manually separated into leaf and stem portions and reweighed.

In 2001, we encountered EAW eggs and insects in lamb extrusa during the last week of January and throughout February (Figure 1). During the last 3 days of grazing (Figure 2), when only about 4 inches of alfalfa stem material remained in the paddocks, we found EAW eggs and insects in lamb extrusa in late January and to lesser extents throughout February. These data demonstrate that grazing lambs do indeed consume EAW eggs and insects that are feeding on winter alfalfa. For paddocks grazed in January and February; on March 5, 2001, at the first alfalfa hay harvest after the cessation of grazing, grazed paddocks produced higher ($P < 0.05$) hay yields, 3993 lb/ac; than the control, 3305 lb/ac; the Furadan®-treated plots, 3764 lb/ac; or the Lorsban®-treated plots, 3217 lb/ac. Paddocks that were grazed by lambs, at the first hay harvest after the cessation of grazing had a higher ($P < 0.05$) leaf percentage of the hay; 63.2% leaf; than the control plots, 57.5% leaf; the Furadan®-treated plots, 58.6% leaf, or the Lorsban®-treated plots, 57.1% leaf. If leafiness is indicative of alfalfa hay quality, not only did lamb grazing improve hay yields at the first hay cutting, but also improved alfalfa hay quality.

For grazing lambs to control EAW in winter alfalfa, the must be grazing as (or before) EAW break estivation and start feeding on alfalfa leaves. For lambs to most effectively control EAW, they must eat the weevil eggs before the weevils and larvae hatch and initiate feeding. During this trial, EAW eggs were most evident in lamb extrusa (Figure 1) during February. Winter lambs from the Imperial Valley start to attain market weight in late January. Unfortunately, when EAW pressure is greatest, lambs are starting their exodus from the Imperial Valley and sufficient lamb numbers may not be available for insect control by grazing lambs. Our initial results do however indicate that grazing lambs, during late winter or early spring grazing, may be beneficial for alfalfa yields.

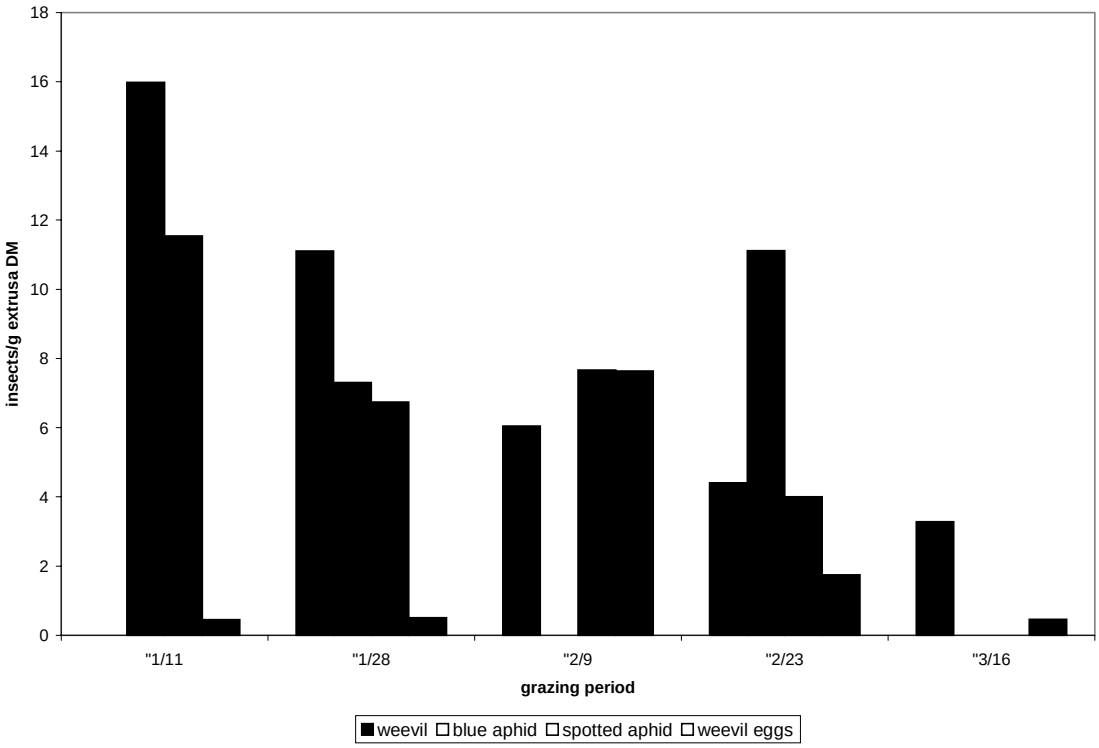


Figure 1. Insects per gm of esophageal extrusa forfirst 3 days of grazing of experimental paddocks during winter grazing of alfalfa in irrigated Sonoran Desert.

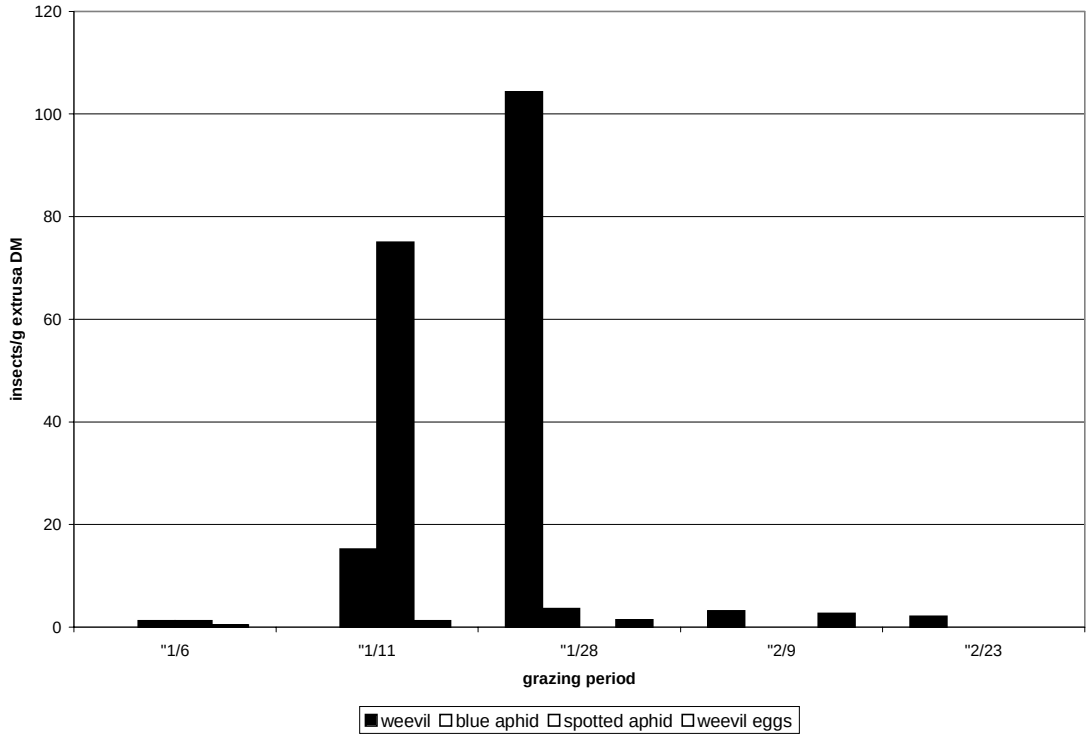


Figure 2. Insects per gm of esophageal extrusa for last 3 days of grazing of experimental paddocks during winter grazing of alfalfa in irrigated Sonoran Desert.

CIMIS REPORT

Khaled Bali and Steve Burch*

California Irrigation Management Information System (CIMIS) is a statewide network operated by California Department of Water Resources. Estimates of the daily reference evapotranspiration (ET_o) for the period of December 1 to February 28 for three locations in the Imperial County are presented in Table 1. ET of a particular crop can be estimated by multiplying ET_o by crop coefficients. For more information about ET and crop coefficients, contact the UC Imperial County Cooperative Extension Office (352-9474) or the IID, Irrigation Management Unit (339-9082).

The Irrigation Management Unit (IID) provides farmers with a weekly CIMIS update. Farmers interested in receiving the updated CIMIS report on a weekly basis can call the IID at the above number. Please feel free to call us if you need additional weather information. Or check the latest weather data on the worldwide web. Imperial County Weather Stations:
http://www.ipm.ucdavis.edu/calludt.cgi/WXSTATIONLIST?COUNTY=IM
California weather databases: http://www.ipm.ucdavis.edu/WEATHER/weather1.html
CIMIS web page: http://www.cimis.water.ca.gov/

Table 1. Estimates of daily Evapotranspiration (ET_o) in inches per day

Station	December		January		February	
	1-15	16-31	1-15	15-31	1-15	16-28
Calipatria	0.07	0.07	0.08	0.09	0.12	0.14
El Centro (Seeley)	0.06	0.06	0.08	0.09	0.12	0.14
Holtville (Meloland)	0.06	0.06	0.08	0.09	0.12	0.14

To simplify our information it is sometimes necessary to use trade names of products or equipment. No endorsement of named products is intended nor is criticism implied of similar products, which are not named.

Keith S. Mayberry
County Director