Agricultural Guide

to Controlling Windblown Sand and Dust

Information in this Guide applies to high elevation desert regions of Southern California. It is based on approximately 20 years of research conducted by the Dustbusters Research Group in the Antelope Valley of Northern Los Angeles County.

ANTELOPE VALLEY DUSTBUSTERS

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Front Cover: Blowing dust in the Antelope Valley has led to reduced visibility and serious traffic accidents. A number of techniques suppress blowing dust, even in very sandy areas.

Back Cover: California poppies, which are native vegetation, stabilize the soil.

Summary

Growers in the high elevation Mojave Desert and other Southwestern U.S. locations encounter extended droughts, high winds, soil erosion, and other circumstances that result in blowing dust. Agricultural soils may be exposed briefly between crops, or as fields are fallowed for 1 to 3 years, grazed by sheep, or taken completely out of production. Any process that reduces vegetation cover also invites dust problems. Wind speeds in this area can exceed 50 mph. When the wind blows, dust from unprotected areas will follow.

Many public and private agencies are available to help growers manage their dust problems. In some cases, financial assistance is available. The techniques in this Guide may serve as a starting point. However, a comprehensive erosion management program may require consultation with experts.

Information in this Guide will assist growers with control of blowing sand and dust. It is based on almost 20 years of research conducted in Antelope Valley by the Dustbusters. It also provides information on cost sharing with federal agencies. Two other Guides have been prepared, one for homeowners and another for large area land managers. *The Homeowners Guide, Large Area Land Managers Guide,* and *Agricultural Guide* may be accessed at the Antelope Valley Air Quality Management District (AVAQMD) website at *http://www.avaqmd.ca.gov/*. Then click on "Windblown Dust Guidance".

Growers in the Antelope Valley can contact one or more of the resources listed in the Resources Guide. Growers in other areas may also benefit from these resources or by contacting similar agencies in their own production areas.

Figure 1: The undisturbed desert is stable and is not a source of blowing dust.

Overview of the Problem

History

Many growers in the Antelope Valley remember the prolonged drought from 1985 to 1992 and the high winds up to 50 mph that propelled giant dust clouds across the Valley. Poor air quality intensified respiratory health problems, reduced visibility and triggered major highway accidents. Deep deposits of blown sand negatively impacted crop production and property values. (See Figures 2 and 3.)

Desert soils are typically crusted and protected from wind by scattered native vegetation. Soils are also protected by crops. Agricultural production in the Antelope Valley generally consists of rotations among forage crops (alfalfa, grains, hay), onions, carrots, and potatoes. Even areas of loose sand are protected if vegetation coverage is sufficient.

Vehicle traffic, construction activities, and agricultural production can damage or destroy vegetation, disrupt crusts, and lead to wind erosion. In agricultural production systems, some ground remains fallow for more than 1 year to reduce soil-borne pathogens or for economic reasons.

Figure 2: Land clearing for agricultural or other purposes can initiate a self-perpetuating cycle of disturbance.

Figure 3: Blowing sand can bury crops or sandblast them.

Why Dust Blows

For growers, blowing dust comes from two sources, land you own or lease and the land upwind of it. Sand blowing from upwind may cause your previously stable ground to begin to erode, as high winds pick up loose sand particles and bounce them along the ground. This saltation of sand and other coarse particles sandblasts the soil surface, eroding the stable crust, dislodging additional particles, and causing further erosion. Saltating particles can kill vegetation, scour stable land, and cause dust to be lofted into the air. (See Figure 4.) Wind rarely lifts sand higher than about 3 feet above ground. However, fine dust rises much higher, which eliminates any practical means of capture.

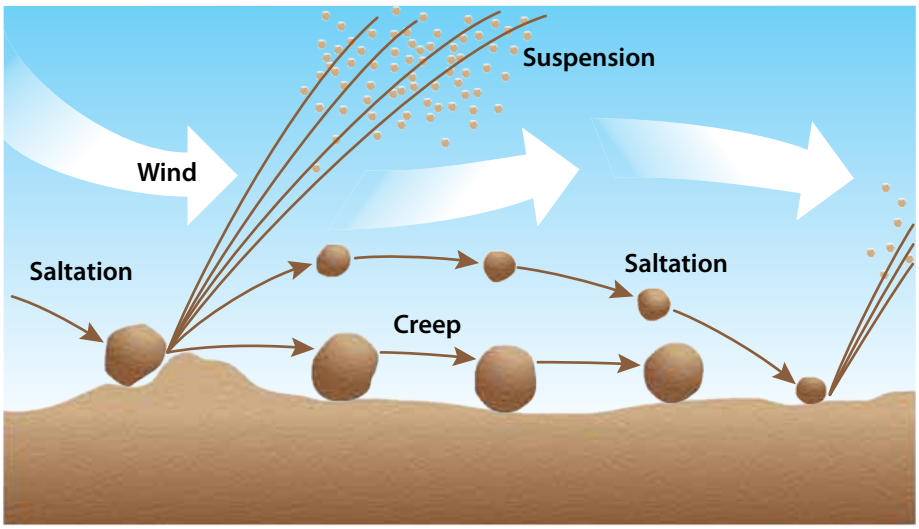

Figure 4: Wind erosion begins with particle creep (rolling) of large particles. Soon, saltation (bouncing) of sand particles begins. These energetic particles erode even stable soil, causing suspension of dust particles into the air.

As a grower, you may choose to implement procedures that control dust, in order to improve visibility, reduce wind erosion and loss of topsoil, minimize damage to roads and structures, and limit health impacts due to poor air quality. Effective dust control methods conserve your topsoil, protect your downwind cropped acreage, and support compliance with air quality regulations. Soils remain viable for production only when soil loss is held below about 5 tons per acre per year. Dust regulations require submittal of a Best Management Practice Plan that includes selection of Practices for Agricultural Operations specifically developed for control of fugitive dust in the Mojave Desert.

Effective Dust Control Measures

Growers typically encounter dust problems with farmland, farm roads, equipment yards, and deep sand.

A number of dust control measures address these problems and have been evaluated in the Antelope Valley.

To establish an effective dust control program, determine:

- How long protection needs to last
- Which crop will follow the protected period
- How much irrigation water will be available.

Figure 5: Irrigation may be the key to establishing vegetation for dust control.

Table 1 on the next page lists these measures and their associated U.S. Department of Agriculture Natural Resources Conservation Service (USDA/NRCS) Conservation Practice Codes.

Cost Sharing Programs and Conservation Technical Assistance

Growers can receive conservation planning and technical assistance from the local NRCS office for dust control and a wide array of natural resource concerns, such as water quality, water conservation and wildlife. You may be able to receive financial assistance as well, through the local NRCS Environmental Quality Incentives Program (EQIP), which provides cost share funds to implement the Conservation Practices listed in Table 1. For Practice requirements, job sheets, and other information, contact the Lancaster Service Center of USDA/NRCS office at 661-945-2604.

The Conservation Reserve Program (CRP) is another cost share program. It encourages growers to voluntarily plant permanent areas of grass and trees on land that needs protection from erosion. This vegetative cover also serves as a windbreak. Additional information is available from the local USDA Farm Service Agency at 661-942-9549.

Table 1: Dust control practices to consider in the Antelope Valley and their associated USDA/NRCS Conservation Practice and Reference Code

Situation	Suggested Practices	Conservation Practice	USDA/NRCS Reference Code*
Farmland – high or low elevation	Cover crops – high or low value	Cover Crop	340
	Strip crops	Strip Cropping - Contact your local NRCS for guidance	585
		Cross Wind Trap Strips	489C
		Residue and Tillage Management - No Till / Strip Till / Direct Seed	329
	Mulch	Residue and Tillage Management - Mulch Till	345
	Native vegetation – buckwheat (only above valley floor)	Conservation Cover	327
	Roughened surface or furrows across the wind	Surface Roughening or Emergency Tillage	609
	Wind breaks and wind barriers	Windbreak / Shelterbelt Establishment	380
		Herbaceous Wind Barriers	603
	Mulch – wood chips or gravel	Mulching	484
Deep sand	Rice grass	Range Planting	550
	Wind breaks	Windbreak / Shelterbelt Establishment	380
	Mulch – wood chips or gravel	Mulching	484
Farm roads and equipment yards	Chemical coatings	Dust Control on Unpaved Roads and Surfaces	729
	Gravel		
	Paving		

NOTE: This list identifies the most common (but not all) Conservation Practices for growers. For information about additional options or for assistance, growers can contact the Lancaster Service Center of U. S. Department of Agriculture Natural Resources Conservation Service (USDA/NRCS) office at 661-945-2604. Additional resources are listed in the Resources Guide.

* For more detailed information about these Conservation Practices, go to the USDA/NRCS website *http://www.ca.nrcs.usda.gov/*. Under Quick Access in left margin, select Electronic Field Office Technical Guide (eFOTG). Then click on California Map to select county. Page opens to display list of eFOTG sections in left margin. Select Section IV; then select Table of Contents. As an option, select Conservation Practices under the individual folders that appear under the Table of Contents heading.

Cover Crops in Field Cropping Systems

Cover crops include grasses, legumes, and forbs for seasonal cover and other conservation practices. (See Figure 6.) They effectively reduce erosion from the wind. They can be used on all arable lands and even on very sandy ground with appropriate techniques.

Figure 6: Even in sandy areas, it may be possible to install a cover crop such as barley, particularly with favorable rains or irrigation. Planting across the wind provides considerable suppression of blowing sand.

Use cover crops when large acreage is leased and/or will be farmed in the near future. Cover crops add organic matter and nutrients to soil and may break disease cycles. Yields of subsequent crops may be significantly improved. Selection of a cover crop requires a cost-benefit analysis. Growers may select a cover crop based strictly on economic analysis or because it fits into their rotation in terms of equipment, planting dates, markets, or potential for hosting pests.

High value cover crops such as cowpea and *Sesbania* perform well in the Antelope Valley. They are relatively expensive to establish, but they improve soil quality and may provide a sizeable economic return. Consider using high value covers if the fallow period is only a few months and particularly if it is followed by high value vegetables.

Lower value cover crops such as cool season grains (i.e. barley, wheat) and warm season Sudangrass also perform well in this area. They are less expensive to establish but provide less benefit to soil than higher value options. However, they better resist degradation and therefore can stabilize land for up to 3 years.

Residue breakdown is critically important in cover crop selection. When vegetables follow a fallow period, avoid cover crops with high C:N ratios, such as cereals or Sudangrass. These crops slow residue breakdown and immobilize nutrients.

Mustard is a suitable cover crop for short term fallow farm land. It produces a low C:N ratio and breaks down quickly in the soil, releasing high levels of nitrogen. Mustard appears to enhance soil structure and increases yields of following crops such as carrots.

Although there is the potential for mustard residue to be a *Pythium* population host, research has shown definitive evidence that mustard cover crops increase cavity spot levels. Cover crops with similar properties are *Sesbania* and cowpeas.

Table 2 suggests cover crops for the Antelope Valley.

Table 2: Suggested cover crops for the Antelope Valley

Category	Type	Persistance	Crop Characteristics
Low cost	Cool season cereal grains	< 3 years	**Cereal Grains** – Easy to establish; marketable as forage. When planted in fall, may germinate on winter moisture. Without winter moisture, may need approximately 8 inches of irrigation. Suitable cereal grains include barley, wheat, and oats. For information about current variety choices, contact agencies listed in Resources Guide.
Moderate cost	Cool season mustard	<3 months	**Mustard** – Short growing season; breaks down quickly in soil (<3 months). May suppress soil-borne nematodes, diseases, and in some cases weeds, but not a reliable substitute for Vapam fumigation. Returns applied N to soil but does not fix N.
High cost-high value	Cool season legume, vetch	<3 months	**Vetch** – Cool season legume; residue breaks down quickly (< 3 months). Adds N by fixation. Plant October – February.
Moderate cost	Warm season Sudangrass	< 3 years	**Sudangrass** – Warm season forage; plant after April. After harvest, stubble residue will hold soil and prevent it from blowing. For a grain crop during growing season, plant Sudangrass from late April through July. Requires supplemental irrigation. Can be chopped in summer and stubble will stabilize soil for remainder of season or subsequent seasons.
High cost-high value	Warm season legumes	< 3 months 3-6 months for *Sesbania*	**Legumes** (cowpeas, other beans, and *Sesbania*) – Break down in soil quickly. Add N by fixation. Plant before August for maximum benefits.
High cost-high value	Perennial native shrubs	> 3 years	**Permanent cover species** – If land will be removed from cultivation for an extended period, consider planting saltbush *(Atriplex spp.)*; California Buckwheat *(Eriogonum)*; Rabbit brush *(Chrysothamnus nauseosus)*; Indian rice grass *(Oryzopsis hymenoides)*. May require starter irrigation and are inhibited by excess soil nitrogen. Will hold soil indefinitely once established.

NOTE: Table A1 in the Appendix provides recommended planting procedures for selected cover crops in the Antelope Valley.

Stripcropping

Stripcropping consists of growing row crops, forages, small grains, or fallow in a systematic arrangement of equal width strips across the wind. (See Figure 7.) The practice can reduce costs and soil erosion and can protect growing crops from damage by wind-borne soil particles.

Figure 7: Strip cropping reduces expense while providing nearly all the benefit of a full cover crop.

The erosion-resistant (planted) and erosion-susceptible (unplanted) strips should be equal width, in multiples of the width of planting equipment, so that at least 50% of the ground is erosion resistant. No adjacent strips should be erosion-susceptible at the same time. When the strip orientation is not perpendicular to the wind, adjust the width, with the effective width measured along prevailing wind erosion direction and the minimum width determined by the width of the unplanted strip.

Agronomic Practices for Planting Cover Crops

These variations on cover crop practices consist of managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year round. The emphasis is on minimizing soil-disturbing activities to only those necessary to place nutrients, condition residue, and plant crops. All or part of the field may be cultivated, as appropriate.

Access roads may allow erosion and their width must be considered in laying out the resistant strips.

Table 3 provides recommended planting dates, seed rates, and depths for cover crops and native species in the Antelope Valley.

Table 3: Recommended planting dates, seed rates, and depths for cover crops and native species in the Antelope Valley

Crop	Planting Date	Seed Rate (lbs/acre)	Seed Depth
Cowpeas	May 1 - July 30	30 lbs	0.25-0.50 inches
Sesbania	May 1 - July 30	8 lbs	0.25 inches
Sudangrass	May 1 - July 30	50 lbs	1 inch
Native species	October - February	Dependent upon species. Consult seed company	Broadcast / drill 0.50 inches
Cereal grains	October - February	50 lbs	2 - 4 inches

Cover Crops in Perennial Tree and Vine Systems

In orchards and vineyards, consider using cover crops as a dust control method. (See Figure 8.) Many orchards and vineyards are drip irrigated and are not set up for irrigation between crop rows. Thus, common cover crops for vineyards are annual grains or drought tolerant grasses. Plant these in fall or winter for germination on winter moisture. They do not require supplemental irrigation. When selecting a cover crop in perennial trees and vines, evaluate problems associated with insect control. Cover crops can host pests such as spider mites and leaf hoppers, as well as beneficial insects.

Figure 8: Prevent erosion between rows of permanent crops with a cover crop. The cover may be chosen to provide nitrogen or other horticultural benefits.

Long Term Native Plant Cover

Consider using native species for fallow periods longer than 3 years and land to be removed from cultivation. These species provide the greatest sustainability and return the system as closely as possible to its natural state, which typically resists erosion. (See Table 2, "Perennial native shrubs" section.) For more information about native species, contact the Antelope Valley Resource Conservation District or the Lancaster Service Center of USDA/NRCS listed in the Resources Guide.

Exposed Desert

Wind erosion may be reduced on rangeland open desert or other suitable locations through establishment of adapted annual or perennial vegetation such as grasses, forbs, legumes, or perennial shrubs and trees. This practice may be applied where desirable vegetation is below the acceptable level for dust suppression and natural reseeding to occur.

Wind Breaks

Wind rarely lifts sand higher than 3 feet above ground. This allows wind breaks to trap blowing sand as it enters land from upwind areas or is blown from disturbed land. Wind breaks can be solid or porous barriers. (See Figures 9 and 10.) In either case they slow the wind and cause it to drop its burden of sand.

To keep the system functional as long as possible, remove or smooth sediment that accumulates along the edges.

Solid Fences

Wood or concrete block fences are solid wind barriers. They collect blowing sand only on the barrier's upwind side. In general, little sand will pass the barrier until collected sand on the upwind side reaches the top of the fence. When sand begins to blow across the top, either increase fence height or remove the collected sand. Install these barriers along the upwind edge of your property.

Porous Fences

Porous plastic fences are partial wind barriers. Openings in fences slow the wind and cause blowing sand to deposit mostly on the downwind side. Because the area of sand accumulation is larger than with solid fences, its depth is reduced and sand removal is required less frequently. However, little vegetation will grow where unstable sand accumulates.

These barriers may also be installed along the upwind edge of property or at intervals downwind across property. A 4-foot porous polyethylene sand fence will deposit blowing sand within about 40 feet of the fence.

Straw Bales

Straw bales are often available on farms. Use these to erect solid or (by spacing them) porous barriers. These are most effective as wind breaks when they are at least 6 feet high.

Soil Surface Modification

The soil surface can be modified by performing tillage operations that create random roughness. (See Figure 11.)

Figure 9: Porous wind fences are commercially available. They trap blowing tumbleweeds as well as sand. In areas with endangered species, such as the desert tortoise, openings should be provided at intervals to allow for continued natural migration of the animals.

Figure 10: The combination of wind fences and seeding of cover crops such as barley may reinforce each other. Even with poor establishment on very sandy ground, the combination may suppress wind erosion enough to initiate stabilization.

Figure 11: Tillage across the wind is very effective in controlling wind erosion. It may serve as an emergency measure or as preparation for seeding of native species.

Several techniques for roughening the soil surface may provide rapid suppression of wind erosion. Ripping soil to bring clods to the surface may be sufficient to disrupt wind and interrupt saltation of sand particles. Bedding or furrowing soil may also be effective, particularly across the wind. Blowing sand tends to collect in the furrow bottoms. Roughening is not effective in deep sand.

Berms

Berms provide more dramatic and long-lasting soil surface modification. (See Figure 12.) They are large mounds of earth built perpendicular to the wind. They may be stabilized with wood chips, vegetation, or other covering, or with wind fences. Berms slow the wind and cause sand to deposit mostly on the upwind side. Currently, wood chips are available free of charge from municipal waste sources.

Figure 12: Berms are semi-permanent features on the landscape that provide effective reduction of blowing sand.

To keep the system functional as long as possible, remove or smooth sediment that accumulates along the edges.

Large Trees and Shrubs

Large vegetation, such as trees and shrubs, planted in a single or multiple rows, provides protection from blowing sand, similar to wind fences. (See Figure 13.) They also leave an attractive landscape feature after sand encroachment has been solved. To grow properly, vegetation needs moisture and protection from sandblasting. Plant vegetation along the downwind edge of a berm or other wind barrier. This will protect vegetation until it matures and begins to reduce wind speed on its own.

Figure 13: Wind barriers made up of permanent vegetation provide effective protection from blowing sand. They are too slow for emergency applications but provide long term beautification of the landscape.

Use trees to protect seedlings of other crops from sandblasting. However, the cost of establishing and maintaining tree covers can be high. Also, trees require supplemental water in the Antelope Valley, so evaluate water availability and maintenance of irrigation systems.

For more information about specific types of trees and shrubs, contact the Antelope Valley Resource Conservation District or Lancaster Service Center of USDA/NRCS listed in the Resources Guide. For irrigation requirements for evergreens, see Appendix Table A2.

Surface Coverings

Dust control can be a problem on unpaved roads where there is vehicle and machinery traffic and on unpaved areas such as farmsteads, materials handling areas, equipment parking lots, and construction sites. Surface coverings can stabilize loose soil in these areas and may consist of almost anything that covers the sand and increases surface roughness. With the possible exception of wood chips, discussed below, these techniques would interfere with future cropping and should be avoided on land that will be returned to production.

Mulching involves applying plant residues, by-products, or other suitable materials produced off site to the land surface. Wood chips, gravel, or even plastic sheeting can be used as mulch. A thin layer (2-3 inches) of wood chips is a quick, easy way to temporarily stabilize small areas of accumulated sand while vegetation grows. This layer provides protection for up to 5 years. Currently, wood chips are available free of charge from municipal waste sources.

Gravel is more expensive and longer lasting than wood chips. It is most appropriate for roads and equipment yards.

Plastic mulches may be appropriate in permanent cropping systems, where they may offer additional benefits in moisture conservation and insect management.

Chemical dust suppressants are polymers that bind the soil surface, making it resistant to dislodging and saltation of sand particles. Other surface covering options include road base materials, road oils, oil and aggregates, and asphalt. For dust control, these products can be applied to roadways and equipment yards but not to production fields. The longevity and cost depends on the specific product.

For more information about dust control on unpaved roads and unpaved areas, visit the Western Regional Air Partnership (WRAP) at *http://www.wrapair.org/forums/dejf/fdh/index.html*.

Acknowledgments

The development and production of this Guide was funded by the following organizations. Without their contributions, publication of this Guide would not have been possible.

- Antelope Valley Air Quality Management District/Mojave Desert Air Quality Management District
- Antelope Valley East Kern Water Agency
- Antelope Valley Resource Conservation District
- City of Lancaster
- City of Palmdale
- Kern County Air Pollution Control District/Desert Mountain Resource Conservation and Development Council
- Sanitation District of Los Angeles County
- Southern California Edison Company
- South Coast Air Quality Management District
- United States Department of Agriculture Natural Resources Conservation Service

We also wish to thank the many participants in the focus groups for reviewing and assisting with the information in this Guide.

Disclaimer

The dust mitigation measures, research results, and conclusions and recommendations expressed in this Guide are solely those of its authors and contributors and are not necessarily endorsed by the many agencies, organizations, and companies who have supported and contributed to Dustbusters Research.

The user of this Guide must determine the appropriateness of a specific measure and must avoid creating fire, drainage, flood, or other safety issues when implementing dust mitigation measures. The user is advised to check with local agencies regarding safety and regulatory issues.

Resources Guide

The following is a list of organizations that can help you select and implement the most cost-effective dust mitigation measures to address your problem:

Antelope Valley Air Quality Management District (AVAQMD) at **661-723-8070**; at website *http://www.avaqmd.ca.gov/*; or email *bbanks@avaqmd.ca.gov.*

Antelope Valley Resource Conservation District (AVRCD) at **661-945-2604**; at website *http://www.avrcd.org/*; or email *avrcd@carcd.org*.

Antelope Valley Resource Conservation District Nursery (AVRCD) at **661-942-7306**; at website *http://avrcd.org/nursery.htm*; or email *avrcd@carcd.org*.

Kern County Agricultural Commissioner at **661-868-6300**; at website *http://www.kernag.com/*; or email *agcomm@co.kern.ca.us*.

Lancaster Service Center of U. S. Department of Agriculture Natural Resources Conservation Service (USDA/NRCS) office at **661-945-2604**; website at *http://www.ca.nrcs.usda.gov/*.

Los Angeles County Agricultural Commissioner at **661-974-8801**; or at website *http://acwm.co.la.ca.us/*; or email *dbrackin@acwm.lacounty.gov*.

U. S. Department of Agriculture Natural Resources Conservation Service (USDA/NRCS); website at *http://www.ca.nrcs.usda.gov/*.

University of California – Los Angeles County Cooperative Extension – Antelope Valley/Lancaster Office at **661-974-8824**; or at website *http://celosangeles.ucdavis.edu/*; or *asbiscaro@ucdavis.edu*.

Other Sources of Information:

The Antelope Valley Air Quality Management District website provides additional information that may help with your selection and implementation of cost-effective dust mitigation measures. Go to the website at *http://www.avaqmd.ca.gov/*; then select "Windblown Dust Guidance," where you will find:

Case Studies

Provides descriptions of several successful windblown dust mitigation field case studies that have been conducted in the western Mojave Desert since 1992. During these case studies, several different dust mitigation strategies were developed, tested, and implemented.

Publications

Provides a list of peer reviewed open literature and conference papers. Also provides access to the complete papers.

Extended Abstracts of Publications

All peer reviewed publications have an abstract of approximately 300 words.

Reports

Provides a list of reports developed by the Dustbusters Research Group since 1992, organized by topic. Also provides access to the complete reports.

WRAP

You will also find information at the archived Western Regional Air Partnership (WRAP) at website *http://www.wrapair.org/forums/dejf/fdh/index.html*. WRAP provides access to the fugitive dust handbook developed by the Western Regional Air Partnership. This comprehensive handbook discusses the fugitive dust problem, mitigation solutions, and costs associated with the various control measures.

Appendix: Irrigation Requirements

Table A1: Recommended planting procedures for selected cover crops in the Antelope Valley.

Type of Cover Crop	Suggestions for Stand Establishment
High cost cover (cowpeas)	Pre-irrigate with 1-2 inches of water. Apply 150 units of N (ammonium sulfate). Irrigate for short durations of 2 hours per day for 2 weeks. For more information, contact the University of California Cooperative Extension listed in the Resources Guide.
Low cost cover (cereal grain or Sudangrass)	Place irrigation in field if needed or not expecting winter moisture; pre-irrigate with 1 inch. If irrigation will be limited, pre-irrigate with 2-3 inches. Irrigate 6-8 inches for season, if available. If sub-moisture is available, adjust drill depth to reach moisture. Grain will emerge from 3-4 inches deep. Apply 40 to 80 units of N only if irrigation is supplied. Do not irrigate prior to emergence because this reduces emergence. Replant if rain exceeds 0.5 inches or forms a crust. For Sudangrass, plant in May if possible. Will not emerge if planted after August. Irrigate for several weeks and fertilize for acceptable stand.

Table A2: Irrigation levels for establishment and maintenance of evergreen trees in the High Desert, expressed in gallons per tree per day. Data obtained near Victorville, California.

	WINTER Dec 21 - Mar 20			SPRING Mar 21- Jun 20			SUMMER Jun 21-Sep 20			FALL Sep 21 - Dec 20		
Height of Tree (Feet)	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
3	0.2	0.2	0.3	0.4	0.6	0.9	1.3	1.5	1.3	0.9	0.5	0.3
6	0.3	0.3	0.5	0.7	1.1	1.9	2.6	3.0	2.6	1.9	1.1	0.5
9	0.5	0.5	0.8	1.1	1.7	2.8	3.9	4.5	3.9	2.8	1.5	0.8
12	0.6	0.6	1.1	1.4	2.3	3.7	5.2	6.0	5.2	3.7	2.0	1.1
15	0.8	0.8	1.4	1.8	2.9	4.7	6.5	7.5	6.5	4.7	2.6	1.4
18	0.9	0.9	1.6	2.2	3.4	5.6	7.7	9.0	7.7	5.6	3.1	1.6
21	1.1	1.1	1.9	2.5	4.0	6.5	9.0	10.5	9.0	6.5	3.6	1.9
24	1.2	1.2	2.2	2.9	4.6	7.4	10.3	12.0	10.3	7.4	4.1	2.2
27	1.4	1.4	2.4	3.2	5.1	8.4	11.6	13.5	11.6	8.4	4.6	2.4
30	1.5	1.5	2.7	3.6	5.7	9.3	12.9	15.0	12.9	9.3	5.1	2.7
33	1.7	1.7	3.0	4.0	6.3	10.2	14.2	16.5	14.2	10.2	5.6	3.0
36	1.8	1.8	3.2	4.3	6.8	11.2	15.5	18.0	15.5	11.2	6.1	3.2
39	2.0	2.0	3.5	4.7	7.4	12.1	16.8	19.5	16.8	12.1	6.6	3.5
42	2.1	2.1	3.8	5.0	8.0	13.0	18.1	21.0	18.1	13.0	7.1	3.8

Developed by R.T. Lanphier C.E.T.
USDA Soil Conservation Service
Provided courtesy of the Mojave Water Agency

Dustbusters Research Group

In 1991, the Dustbusters Research Group formed a partnership to develop best management practices for mitigating wind erosion, reducing blowing dust, and improving air quality in the Antelope Valley. Since then, this Group has developed and implemented a land treatment program to minimize wind erosion through vegetative, physical, and chemical stabilization procedures.

This Group consists of private entities and federal, county, and city government representatives. For a complete listing of participants, go to the Antelope Valley Air Quality Management District's website at *http://www.avaqmd.ca.gov*.