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June 16, 2015

California Department of Water Resources
Urban Water Use Efficiency Unit
ATTN: Ms. Julie Saare-Edmonds, Senior Environmental Scientist
P.O. Box 942836
Sacramento, CA 94236-0001

Re: Update of the State Model Water Efficient Landscape Ordinance (WELO)

Dear Ms. Saare-Edmonds:

I am a horticulturist from the east coast, with over 30 years of experience working with compost and other organic recycled products. I am an ex-Board member of the US Composting Council and a recipient of their "Clean Water" Award. Further, I have been training California landscape architect and engineers for many years and have assisted Caltrans in the development of their compost and compost usage specifications. Finally, my company, R. Alexander Associates, Inc., has many clients in the State of California and is a corporate tax payer in the State.

I am writing to impress upon your organization how important it is for you to include composted products (soil amendment and mulches) in your next WELO ordinance version. I know that many organizations from the composting industry have provided technical support for such a strategy, as have I (attached), but my particular reasoning is pretty basic:

- Compost (and related mulches) holds water, thus reducing irrigation,
- The amended soils accept rain water more readily, which can not only reduce irrigation, but reduce pressure on the storm water management infrastructure (which is very expensive),
- Plants grown with compost have a better chance of survival reducing long-term site management costs (and irrigation),
- Adding humified carbon is key to reducing the effects of climate change, and
- The State's organic waste management objectives (75% waste reduction, no more yard trimmings as ADC, etc.), climate change, and water reduction regulations/strategies are all intrinsically related, and therefore should be linked…for the greatest Statewide success and cost savings.

For these reasons, I support a *requirement for a specific amount of compost, as well as an increased amount of mulch, to be added as a part of this ordinance*. Providing guidelines for the minimum amount of compost and mulch used in new and existing landscape improvements will aid the state in meeting its water conservation goals and also aid the state in improving statewide soil quality which has multiple environmental benefits including water conservation and carbon sequestration.

I would recommend that the updated WELO require the incorporation of two inch of compost into soils and three inches of mulch on top of the soil in planted areas. Costs for adding these levels of compost and mulch are negligible, and are highly beneficial to the development of sustainable landscapes and the overall environment.

If you have any question, please do not hesitate to contact me or visit our websitewww.alexassoc.net

Sincerely,

Ron Alexander
President

SAMPLE OF RESEARCH

MULCHING

***STRATEGIES FOR REDUCING WATER INPUT IN WOODY LANDSCAPE PLANTINGS*, A.M. Smith and D.A. Rakow. Journal of Arboriculture 18(4): July 1992.**

'A comparison of four mulch types (shredded bark, fine bark, wood chips and medium grade gravel) to are soil (bare) controls, showed that all mulch types resulted in less evaporational water loss. The shredded bark and medium grade gravel providing the greatest reduction in evaporational water losses.'

Percent evaporative water loss saving by treatment and depth compared to control for shredded bark, gravel, wood chips and fine bark at depths of 3.8 cm and 7.6 cm, in 20 L containers.

Mulch type	**Mulch depth**	
	3.8 cm	7.6 cm
Shredded bark	43.8%	43.8%
Gravel	48.7%	52.6%
Wood chips	27.3%	26.7%
Fine bark	33.1%	35.9%

Impact of Mulches on Landscape Plants and the Environment — A Review, Linda Chalker-Scott, *Washington State University, Puyallup Research and Extension Center7612 Pioneer Way E., Puyallup, WA 98371*

These biodiverse, stable landscapes are more resistant to stress, are more aesthetically pleasing, require fewer applications of pesticides and fertilizers, and are ultimately more sustainable than those without mulch cover.

Improved soil moisture. Exposed to heat, wind, and compacting forces, bare soil loses water through evaporation and is less able to absorb rainfall or irrigation as it becomes increasingly compressed. Weeds can increase evapotranspiration of soil moisture by 25% in a summer day (54). In contrast, mulches will increase soil water by increasing percolation and retention, reducing evaporation, and reducing weeds. An early study (105) demonstrated that a layer of straw only 3.8 cm (1.5 in) thick reduced evaporation by about 35% compared to bare soil. Later, Kacinski (62) demonstrated that most mulched soil has greater water retention than bare soil, with the exception of competitive living mulches such as turf.

What is less consistent is how different mulch types influence water movement. For instance, black plastic generally inhibits water movement (7, 12) between the soil and the above-ground environment, thus limiting recharge. Soil water recharge is dependent upon infiltration, which in turn is influenced by surface permeability. Activities and products that compact soils and/or create hydrophobic conditions will limit recharge while increasing runoff and erosion. Plastics, geotextiles, fine-textured organic mulches, sheet mulches, and mulches with waxy components are poor choices in this regard. Therefore, though these mulches may initially increase soil water retention since evaporation is reduced, over the long term they will create soils that are unnaturally dry.

In contrast, there is a wide variety of mulching materials that do not limit soil water infiltration and retention: their one similarity is that they are all permeable materials. Most comparative studies among mulch types indicate that organic mulches conserve water more effectively than inorganic; organic and inorganic are better conservers than synthetic and all are better than bare soil. Mulches with demonstrated ability to retain water include gravel and stone, livestock manure, and a vast array of plant materials. These consist of rapid decomposers such as grass clippings, leaves and local crop residues; moderate decomposers including hay and straw, coir pith, and jute; and slowly decomposing timber residues; including sawdust, and barks and chips from both hard- and softwoods. Cover crops are generally less effective than either organic or inorganic mulches as they must compete with other landscape plant materials for water.

From a practical viewpoint, an appropriate mulch will significantly reduce the amount of irrigation needed for all landscapes, and in some cases can eliminate it altogether. In addition to protecting soil reserves, coarse organic mulches will hold water much like a sponge, thereby capturing rainfall and irrigation water for later release and preventing runoff. An early study demonstrated that 1.5 cm (0.6 inch) of straw mulch reduced water runoff by 43%; mowed sod and bark were likewise found to reduce runoff. Less runoff and improved retention will translate to reduced needs for supplemental irrigation. In addition, mulch protection from drought stress can also protect trees and shrubs from subsequent environmental stresses such as cold injury.

Mulching Reduces Water Use of Containerized Plants, Virginia I. Lohr and Caroline H. Pearson-Mims, Department of Horticulture and Landscape Architecture, Washington State University, Pullman, WA 99164-6414.

SUMMARY. Colorful baskets of flowering annuals are popular with home gardeners, but these containerized plants require frequent waterings. Mulching of field soils is a proven way to conserve soil moisture. This study was conducted to see if mulching would reduce the need to irrigate containerized plants. Adding either pine bark or sphagnum moss mulch to potted 'Impulse Rose' impatiens (*Impatiens wallerana*) plants

reduced the frequency of irrigations when the plants were small and had not yet reached canopy closure. Mulching had no effect on plant height or flowering.

For example, in Experiment 1, plants with sphagnum moss needed to be watered 34% less often than plants without mulch, while plants with pine bark mulch required watering about 20% less often than plants without mulch. In Experiment 3, both mulches were equally effective, with mulched plants requiring watering an average of 13% less often than plants without mulch.

AMEND THE SOIL (Compost usage)

DROUGHT RESISTANT SOIL, ATTRA, www.attra.ncat.org, 800-346-9140, By Preston Sullivan, NCAT Agriculture Specialist November 2002.

To minimize the impact of drought, soil needs to capture the rainwater that falls on it, store as much of that water as possible for future plant use, and allow for plant roots to penetrate and proliferate. These conditions can be achieved through management of organic matter, which can increase water storage by 16,000 gallons per acre foot for each 1% organic matter. Organic matter also increases the soil's ability to take in water during rainfall events, assuring that more water will be stored. Ground cover also increases the water infiltration rate while lowering soil water evaporation. When all these factors are taken together the severity of drought and the need for irrigation are greatly reduced.

Some practices that destroy or degrade soil aggregates are:
- Excessive tillage
- Tilling when the soil is too wet or too dry
- Using anhydrous ammonia, which speeds the decomposition of organic matter
- Excessive nitrogen fertilization
- Excessive sodium buildup from salty irrigation water or sodium-containing fertilizers

METHOD FOR ESTIMATING GREENHOUSE GAS EMISSION REDUCTIONS FROM COMPOST FROM COMMERCIAL ORGANIC WASTE November 14, 2011 Planning and Technical Support Division California Air Resources Board California Environmental Protection Agency.

Water benefits from applying compost to a soil system are due to the increased porosity and permeability of the soil. The California-specific study by Crohn (2010) indicates that compost applied to increase water retention on a fire affected site is 185 gallons/ton of compost and 678 gallons/ton of compost for the construction site for a one year time period. Studies have indicated that humic substances are a major contributor to increased surface water absorption, which allows the soil carbon decay curve to have applicability towards water retention. Over 30 years, this equates to a benefit of 3,550 and 13,000 gallons/ton of compost for the fire affected and construction sites, respectively. Converting gallons per ton of compost to acre feet (AF) and multiplying by the water use emission factor (1.5 $MTCO_2E$/AF) leads to a range of 0.015-0.065 $MTCO_2E$/ton of compost and an average of 0.04 $MTCO_2E$/ton of compost. A series of other studies report a range of 118-810 gallons/ton of compost, which is consistent with the numbers reported for this method. In addition to the above studies, it is important to note that other manuscripts report an increase in water retention and available water to plants due to compost application. However, these studies did not report the variables necessary for inclusion into the above calculations.

Economic Potential of Compost Amendment as an Alternative to Irrigation in Maine Potato Production Systems, ***John M. Halloran[1], Robert P. Larkin[1], Sherri L. DeFauw[2], O. Modesto Olanya[1], Zhongqi He[1] , [1]USDA Agricultural Research Service, New England Plant, Soil, and Water Laboratory, Orono, ME, USA; [2]Department of Agricultural Economics and Rural Sociology, The Pennsylvania State University, University Park, PA, USA.***

Our analyses indicate that compost amendments may be a viable alternative to supplemental irrigation. One major advantage is that it requires no large capital outlay. For example, as Dalton et al. found, a field slightly over 80 ha could cost as much as $200,000 when water development costs were included. This represents a large opportunity cost. In addition, the majority of potato production areas in the Northeast U.S. present significant challenges for irrigation (e.g. lack of surface or ground water source, undulating topography, irregularly-shaped fields, and a high number of non-adjacent fields).

Consideration of weather-related impacts and the probability that in three out of every four years, there is at least one 5-day period where moisture levels are lower than optimal for potato production, compost amendments may serve as an important alternative to supplemental irrigation for improving yield and reducing risk. However, a noteworthy constraint to the SI system is the cost of compost and its application in the short-term (≤4 years). Current market rates for purchasing compost in Maine can run as much as $30 to $40 Mg−1 (Mark Hutchinson, University of Maine, personal communication), which would make compost application much less economically feasible for potato growers. However, with on-farm composting, local availability, and cooperative associations with livestock farms and compost producers, compost costs may be substantially reduced to more favorable levels, making the use of compost far more attractive. Further research is also needed to determine if the same or similar yield benefits from adding compost can be attained at reduced application rates or application frequencies, perhaps also coupled with the feasibility of site-specific applications. Additional considerations involve customization of the compost mixture for a particular application and soil type based on parameters that include maturity, stability, pH level, density, particle size, moisture, salinity, and organic content. Other system modifications such as inclusion of more marketable rotation crops may also serve to improve overall system profitability.