DUST MULCH EFFICACY IN GARDENS AND LANDSCAPES

Introduction

Dust mulching is a soil-water conservation practice recommended by some popular gardening books and websites for home gardeners. While dust mulching may be an effective practice for dryland agricultural production, there is little scientific support for its use in home gardens. This publication reviews the science behind dust mulching and will guide home gardeners to more appropriate mulch materials for their gardens and landscapes.

What Is Dust Mulching?

Dust mulches are made by breaking up the top few inches of the soil with a hoe or rake, creating a finely textured layer (Figure 1). Proponents of dust mulching claim that this process reduces soil evaporation by disrupting channels that move water from the ground into the atmosphere and is superior to organic mulches in conserving soil moisture.

Figure 1. Dust mulching creates a finely textured layer of soil. Photo: L. Chalker-Scott.

Do Dust Mulches Conserve Soil Moisture Better than Other Mulches?

Much of the research on dust mulching comes from studying arid lands in subtropical and tropical agricultural areas. Some of these studies (De and Giri 1978; Sharma 1991) found that dust mulches were effective in improving soil moisture conservation compared to undisturbed bare soils. But most research has found dust mulch to be less effective in conserving water compared to organic mulches, such as straw (Figure 2), leaves, and ground corn cobs (Chaudhary et al. 2007; Gargi and Gautam 2003; Meena et al. 2016; Prasad and Singh 1998; Sarkar and Singh 2007; Sharma and Chakor 1995).

Figure 2. Straw mulch used in a garden setting. Photo: L. Chalker-Scott.

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Can Dust Mulches Provide Other Benefits to Soils?

Another benefit of mulching is moderating soil temperature. Mulched soils are usually warmer in the winter and cooler in the summer. However, researchers have found that dust mulches do not lower daytime soil temperatures in the summer as effectively as organic mulches (Sarkar and Singh 2007). In warm climates, dust mulches can raise the soil temperature enough to increase evaporation and possibly damage or kill fine roots.

Good mulches also reduce the risk of soil erosion. Since dust mulching deliberately creates fine particles of soil, there will be higher risk of erosion by wind or rain. Dust mulching was identified as one of the primary causes of agricultural erosion many decades ago. More recently, researchers have found dust mulching to be a major source of particulate air pollution (Bewick et al. 2008; Thorne et al. 2003). These airborne particles are associated with human health and global climate concerns (Kjelgaard et al. 2004).

Are Dust Mulches Useful in Vegetable Gardens?

Much of the research on dust mulching has examined food crop yields in Africa, Asia, and eastern Washington State. In several studies, crop yields increased in dust-mulched fields compared to bare soil conditions. However, in nearly every instance where dust mulching was compared to organic mulching, organic mulches were found to be superior in enhancing crop yields. These results are relevant to managing a home vegetable garden, as the soil system is being used for annual crop production. As Table 1 shows, dust mulches are usually less effective than organic mulches for improving yields of a variety of different crop species.

Table 1. Comparative effects of dust and organic mulches upon crop yields. Mulches are listed in order of best to worst.

Crop	**Ranking of Mulches[1]**	**Sources**
Barley (*Hordeum vulgare*)	OM > DM	Sarkar and Singh 2007
Buffelgrass (*Cenchrus ciliaris*)	OM > DM	Meena et al. 2016
Butterfly pea (*Clitoria ternatea*)	OM > DM	Meena et al. 2016
Clusterbean (*Cyamopsis tetragonoloba)*	OM > DM	Meena et al. 2016
Corn/maize (*Zea mays*)	OM+DM > OM	Shivran and Rana 2003
	OM > DM	Rajput et al. 2014a, 2014b
Cotton (*Gossypium* spp.)	OM > DM	Senthivel et al. 2008
Cowpea (*Vigna unguiculata*)	OM > DM	Choudhary et al. 2013
Fennel (*Foeniculum vulgare*)	OM > DM	Meena et al. 2014
Mung bean (*Vigna radiata*)	OM > DM	De and Giri 1978
	DM > OM	Verma et al. 2017, 2008
Mustard (*Brassica*)	OM > DM	Chaudhary et al. 2007
Niger seed (*Guizotia abyssinica*)	OM > DM	Mandal and Saren 2012

Crop	Ranking of Mulches[1]	Sources
Pearl millet (*Pennisetum* spp.)	OM > DM	Gargi and Gautam 2003
	OM > DM	Meena et al. 2016
	DM > OM	Singh et al. 1997
Pigeon pea (*Cajanus cajan*)	DM+OM > OM > DM	Prasad and Singh 1998
Sesame (*Sesamum* spp.)	OM > DM	Mandal et al. 2012; Singh et al. 2014
Sorghum spp.	DM+OM > OM > DM	Prasad and Singh 1998
Wheat (*Triticum* spp.)	OM > DM	Sharma and Chakor 1995
	OM = DM	Sharma 1991

[1] DM = dust mulch; OM = organic mulch; DM+OM = dust and organic mulches used together.

Since Dust Mulches Cost Nothing, Can They Be Economically Sound Choices?

Researchers have addressed the economics of dust mulching (Bewick et al. 2008; Kundu et al. 2019; Mandal and Saren 2012; Rajput et al. 2014b; Verma et al. 2008). Only one research team has found dust mulching to be the most cost effective (Verma et al. 2017, 2008), and these results have been inconsistent between years (Verma et al. 2008). While dust mulching requires no material input, it is labor intensive and requires repeated application to prevent weed invasion (Figure 3). In contrast, live mulches (Himangshu et al. 2018; Kundu et al. 2019) and organic mulches made from local crop residues were consistently the best economic choices (Katiyar and Uttam 2003; Prasad and Singh 1998), possibly due to reduced labor and hauling costs. These results align with the information in Table 1. Mulches that provide the best crop yield will also provide the highest economic benefit.

Better Mulch Choices

Decades of research provide strong evidence that dust mulches are not the best choice for either soil management or vegetable production. While they may be better than undisturbed bare soil in conserving soil moisture, dust mulches are not as effective as organic mulches. The comparative benefits of various mulches are described elsewhere (Chalker-Scott 2007), but organic mulches generally outperform other mulches in terms of plant and soil health as they:

- Enhance beneficial microbes and insects
- Enhance gas transfer
- Enhance water infiltration and retention

Figure 3. Neglected dust mulches quickly become colonized by weeds. Photo: L. Chalker-Scott.

- Improve soil structure
- Moderate soil temperatures
- Neutralize pollutants
- Provide mineral nutrients
- Reduce erosion and compaction
- Suppress pathogens and pests

Dust mulching is a practice that is at odds with our increased understanding of soil health, structure, and function. While it may still have practical benefits for dryland agricultural production, it is not appropriate for home gardens, where other mulch choices are readily available.

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