SEEDBED MULCHING - SOME ALTERNATIVES

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ABSTRACT

Abstract. Reasons for mulching nursery seedbeds are reviewed, and results from a survey of southern forest nurseries are presented. Hammermill Paper Company's nursery has utilized a variety of materials for seedbed mulch. The operability of each mulch material system is discussed, and relative costs and benefits are compared. A system that can allow nurseries to become self-sufficient in mulch production is presented as one alternative.

INTRODUCTION

The reasons for mulching forest nursery seedbeds are almost as numerous as the types of mulching materials that have been used over the years. Dr. Jack May in the Southern Pine Nursery Handbook lists 17 different mulch materials that have been used in nurseries in the Southern United States (Lantz 1985). I have attempted to update this list to currently utilized materials by means of a survey of 61 nurseries in the southern states. Results of this survey are included in this paper. **In** addition to a review of the advantages and disadvantages of mulching seedbeds. I will relate the history of mulching practices at the Hammermill Nursery, and some of the innovative ways that we have acquired mulch materials. Finally, I will attempt to look ahead to where we are headed with seedbed mulching, and what the future might hold in terms of new materials and practices.

ADVANTAGES OF MULCHING

Probably the most commonly cited reasons for mulching seedbeds have to do with water relationships in the plant-soil system. Mulches have been shown to increase water infiltration into the soil, reduce evaporation from the soil system, and thereby increase water retention. This is especially true in the topsoil layer (Fig. 1). I will confine my discussion of mulching effects to the topsoil (0 to 6 inch depth), since pine seedling root systems are generally limited to this zone. Mulches are probably most important during the germination phase of seedling development. **In** addition to improving the moisture status of the near surface soil, the benefits of temperature moderation and reduced soil erosion are important during this critical nursery phase. More seedlings are lost to the damaging effects of rainfall than the combined losses due to insects, diseases, and weeds in southern nurseries **(D. B.** South, personal communication). The wood waste mulches (sawdust, bark chips, and woodchips) and straw mulches (pinestraw and grain straws) provide good

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erosion control and lessen the damaging impact of falling raindrops. Soil temperatures on mulched areas fluctuate less than non-mulched areas. Seasonal and diurnal temperature variation is moderated under mulch (Figs. 2, 3 and 4). Fibermulch substances were the most commonly used materials in the 1986 nursery survey, and although Vozzo (1984) noted the minimal insulative properties of this material, it has been shown to reduce soil temperatures (compared to non-mulched control areas), probably due to its light color reflecting substantial amounts of sunlight (Racey and Raitaen 1985).

In addition to modifying the physical soil environment, mulches can have an effect on the biological components in the soil system. Mulches can reduce the germination and emergence of undesirable plant species - better known as weeds. In the days before the introduction of effective herbicides that could be applied over the top of pine seedlings, sawdust and wood waste mulches were considered to be a good method of early season weed control. Hand weeding has been reduced by 60 to 90% with effective use of mulches, although a lesser effect is more common (Duryea and Landis 1984). Biological activity can be enhanced under mulch. Wood chips and sawdust mulches were shown to have a significant impact on increasing the earthworm and beneficial nematode populations (Van Nierop and White 1958). The last advantage of mulching that I will mention is the reduction in soil crusting under mulch. When mulch materials are lost from the seedbed or not used at all, the soil surface can harden, thereby reducing germination and emergence of seedlings (Bland 1973).

DISADVANTAGES OF MULCHING

The most commonly cited reason for not mulching, and especially not using natural mulch materials pinestraw, grain straw, or sawdust, is the introduction of weeds. This can be a very real problem. Pinestraw is notorious for carrying weed seeds. From our experience at the Hammermill Nursery, I know that a field that is essentially "weed free" can be well inoculated with nutsedge tubers coming in with the mulch. In 1985 we hauled eight truck loads of old veneer mill shavings to be used as mulch. The field where we used this material as seedbed mulch had been in production for twelve years, and had a very low population of weed, and no known nutsedge spots. By mid-summer that field had nutsedge coming up *every* where that we used the veneer shavings mulch. This potential problem can be alleviated by fumigating mulch materials, under a tarp, with methyl bromide. This is a labeled use for that pesticide, and I know of several nurseries that routinely fumigate their pinestraw seedbed mulch.

Duryea and Landis (1984) go into some detail about the potential introduction of pathogenic organisms into nurseries through mulch materials. A variety of fungi have been found in sawdust, as well as pathogenic nematodes, and cutworms in the genus (Euxoa and Peridroma. The authors recommend assaying any new or untried sources of mulch for pests and

pathogens. I would add to that recommendation screening for potential weeds and phytotoxic substances. Again, from personal experience, we nearly used some reject wood pulp from our company's mill. Fortunately, we had the presence of mind to send a sample to an analytical laboratory, and found that the material contained phytotoxic levels of sodium and manganese.

The use of mulch has been shown to accelerate the leaching of mobile soil-plant nutrients like nitrate nitrogen (Giddens et al. 1969). This undoubtedly resulted from the increased infiltration and hence percolation of water through the soil profile. Certain mulch materials can actually cause a tie-up of plant nutrients. This has been a problem often reported with the use of "green" sawdust. Finally, Vozzo (1984) did report a reduction in germination capacity for five pine species when he used pinestraw and hydromulch compared to a bare soil surface. He reports that seed germination may actually be enhanced by the greater fluctuation of soil temperatures observed under non-mulched conditions. The insulative properties of the pinestraw and hydromulch would tend to reduce the daily variation in temperature, and thereby reduce the germination capacity of seed sown under these mulches.

1986 MULCH MATERIALS SURVEY

In June of 1986, I conducted a telephone survey of 61 nurseries in thirteen southern states. I only solicited information on the type of mulch used on pine seedbeds. A total of sixty-nine responses were tallied (Table 1). Some nurseries use more than one type of mulch material *over* pine seedbeds.

Table 1. Results of 1986 mulch materials survey

Material	Number of Nurseries	% of Total
Fibermulch	21	31%
Pinestraw	19	28%
Sawdust	12	17%
Grain straw	5	7%
Pine/Hdwd Bark	5	7%
Wood chips	5	7%
No mulch	2	3%
Total:	69	100%

MULCHING HISTORY AT THE HAMMERMILL NURSERY

Since 1974 five different mulch materials have been used at the Hammermill Nursery. Pinestraw was collected and spread on about half of the pine seedbeds in 1974. This material proved to be costly, in short supply in our area, very labor intensive, and introduced many weeds into the nursery fields (C. A. Muller, personal communication). For these reasons its use was abandoned, but you can see by the survey data, 28% of southern nurseries are still using pinestraw. With today's herbicides, fumigation of the straw, and a readily available supply, this material is still a viable option for many nurseries. Bark chips and old sawdust have been used intermittently at this nursery, as their cost and availability became practical. Both worked well, except for the nutsedge problem that I discussed in an earlier section of this paper. Be cautioned that sawdust tends to be prone to movement and loss from the seedbed surface due to winds and rain. Keeping the sawdust moist with the irrigation system is usually the key to keeping it on the beds.

The primary mulch material that we have used over the past 13 years is wood chips from a slasher saw operation. The slasher saw is located only 1-1/2 miles from the nursery, and the saw kerf chips and sawdust are screened through a 1/2 inch shaker screen and deposited in a dump truck for hauling to the nursery. This provides an excellent and inexpensive mulch material. The angular shape of these woods chips cause them to lodge in the soil surface, yet they are light enough not to impede germination and emergence of pine seedlings. We spread the chips with a manure spreader drawn by a tractor, and try to apply about a 1/4 inch layer over the sown seedbed. In our situation, this is the most cost effective and operationally desirable mulch material.

The newest mulch material that we have tried I will call "chipper mulch". It is produced by a small, portable whole tree chipper. We use the chipper for chipping material in our seed orchard (limbs), thinnings from progeny tests and other research test plantations, and disposing of submerchantable trees around the nursery property (fencerows, prunings, storm blowdowns, etc). We are currently studying the feasibility of biomass plantations on the nursery property. This would give us a sustainable source of mulch materials in the future. This may be important because over time, one by one, we have lost the availability of mulch materials (sawdust, bark and wood chips) to competing wood waste burning industries. Preliminary testing of this "chipper mulch" material in 1986 showed it to be a good seedbed mulch, and not prone to displacement by wind or water. Composting the "chipper mulch" is probably advisable due to the amount of leaf material in fresh chippings, and to give potential weed seeds a chance to be killed by the high temperatures of the composting process. In our experience, a six month composting period should be adequate.

OUTLOOK FOR THE FUTURE

Wood waste mulches will continue to be competitively sought for energy generation, and may be priced out of the nursery mulch market. With this in mind, we need to always be on the lookout for potential solutions to our mulching problems. At least one nursery has tried a "living lulch" (J. E. Dennis, personal communication). They sowed winter rye on seedbeds made in the fall, and in the spring killed the rye with a herbicide, and drilled their pine seed in the remaining *rye* stubble. This system may have some promise. The possibility of a synthetic mulch material seems plausible. Vegetable growers use polyethylene sheets as a mulch and place slits in the sheets for plants to grow through. A system similar to this could be developed for forest tree nurseries. Finally, although not strictly a mulch material, but rather a soil stabilizer, Geotech has looked very promising in nursery tests. This material is a polymer that "fixes" the soil surface to impede surface erosion, while still allowing infiltration of water, and emergence of seedlings. Geotech by itself or in combination with some type of mulch material could help reduce the often devasting seedling losses causes by rainfall.

CONCLUSION

I have attempted to summarize the benefits, and some of the shortfalls of seedbed mulching in pine seedling nurseries. Each nursery is different in terms of climate, soils, species grown, and cultural practices employed. I have outlined what we have tried at the Hammermill Nursery; some things have worked, others did not and were abandoned. Each nursery will have to evaluate the costs and benefits of a particular mulch material to find out which system works best for them. I am certain that we will continue to see changes and adaptations in this facet of nursery practice, as economic conditions and technologies change.

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Figure 1. The Effect of Sawdust Mulch on Available Soil Moisture for Tomato Area – Cecil Sandy Loam. (Giddens et al 1969)

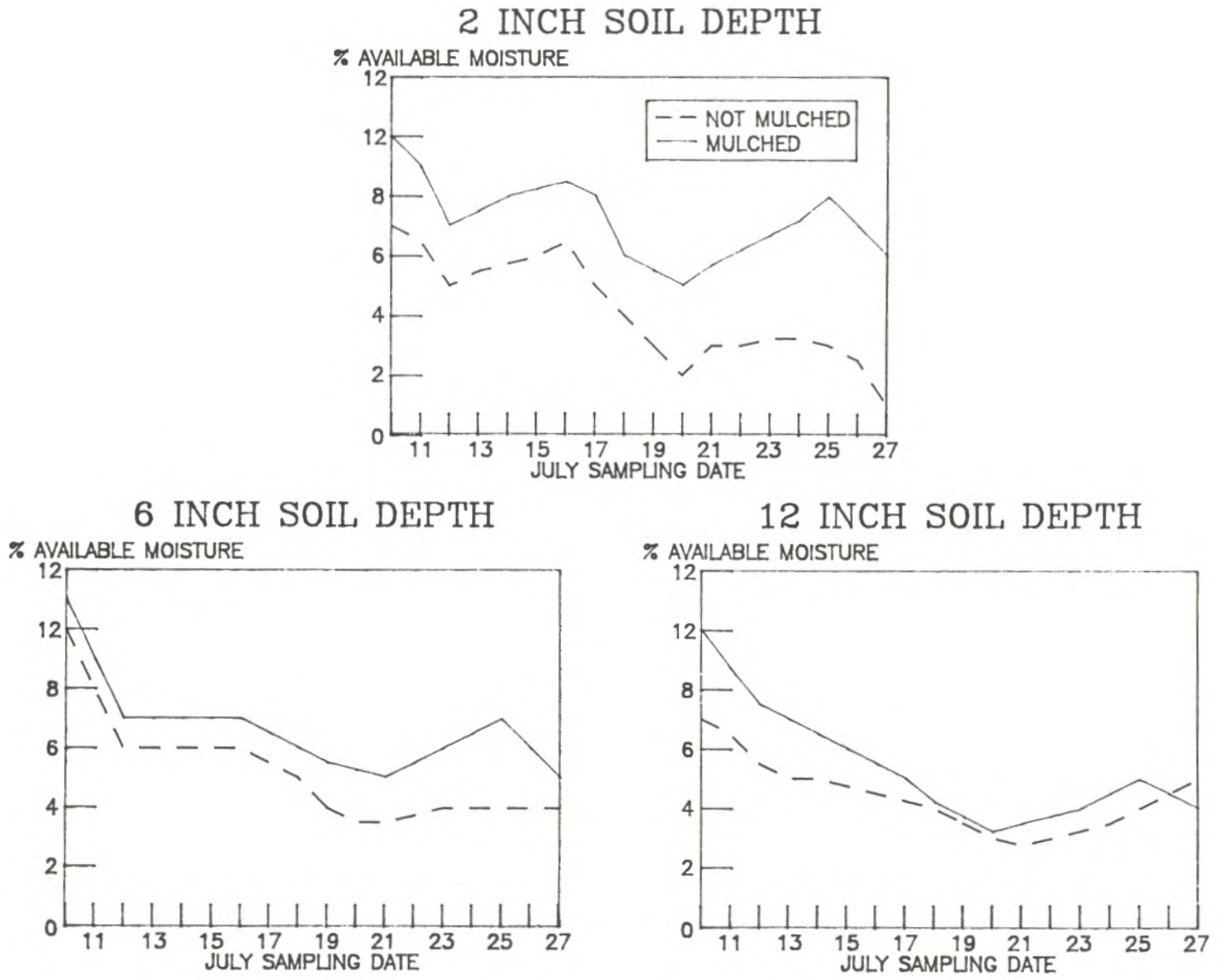


Figure 2. Effect of Grain Mulch on Maximum Cecil Sandy Loam Soil Temperature at 1 and 4 in. Depths Where Crimson Clover Was Grown. (Giddens et al 1969)

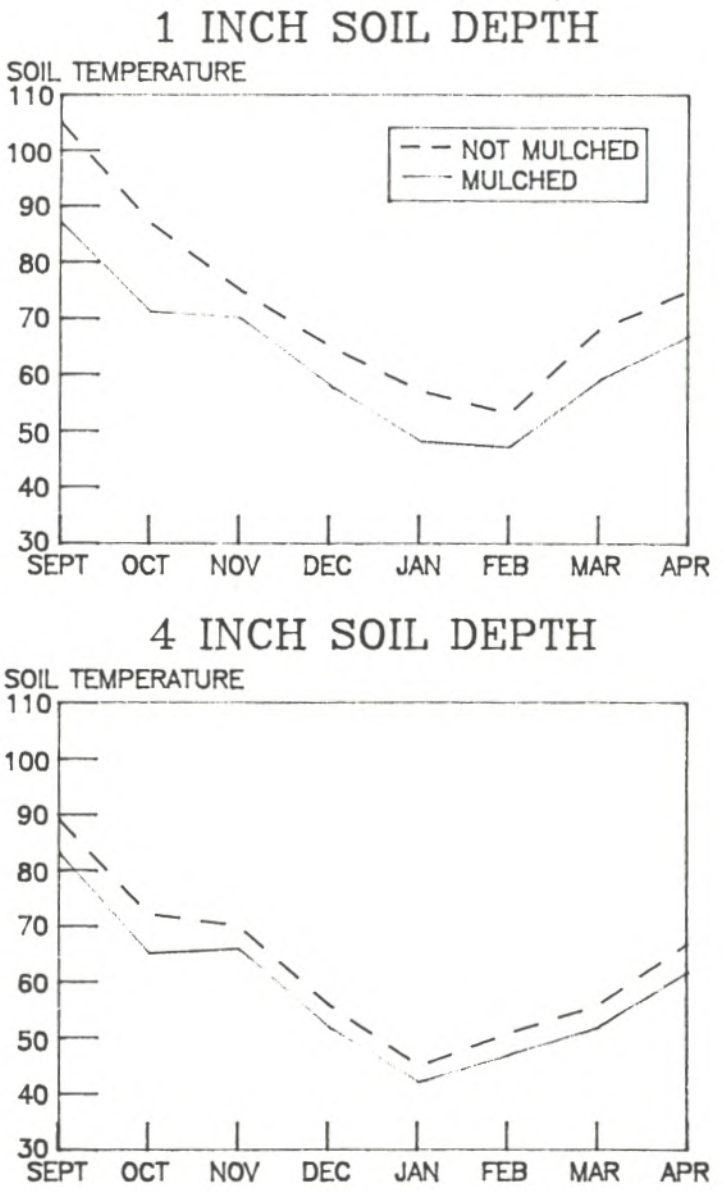


Figure 3. Effect of Sawdust Mulch on Soil Temperature of Cecil Sandy Loam. (Giddens et al 1969)

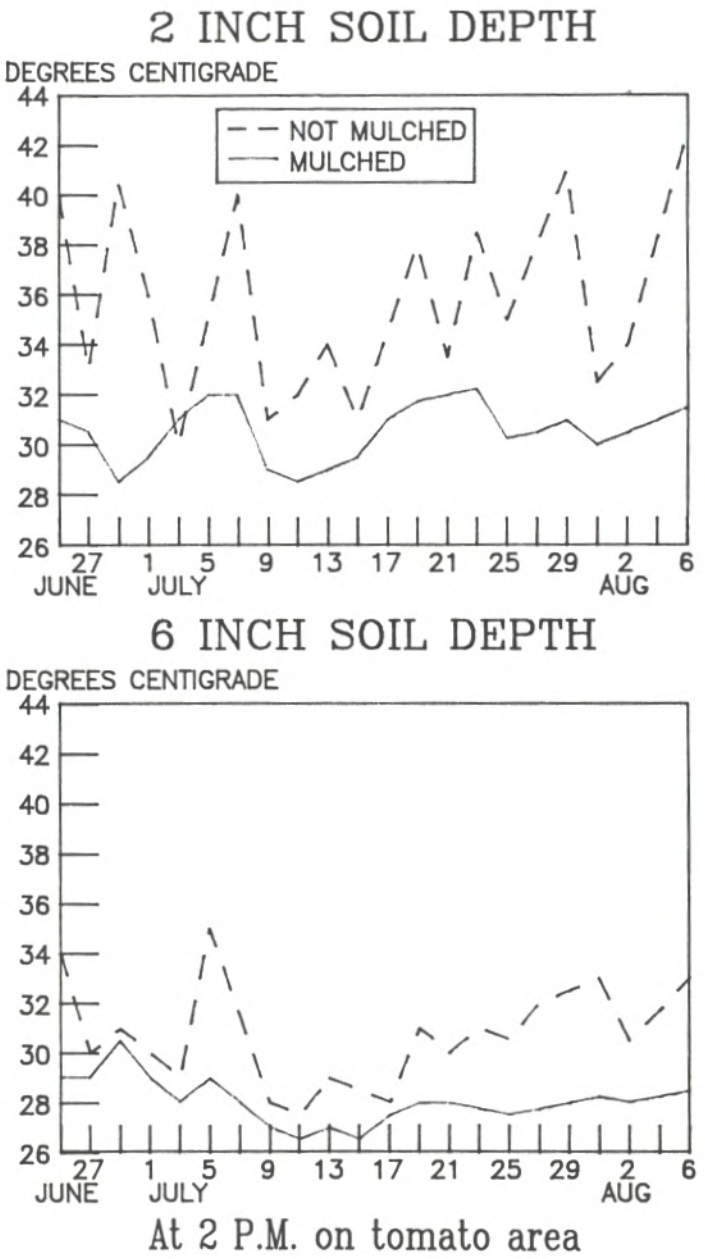
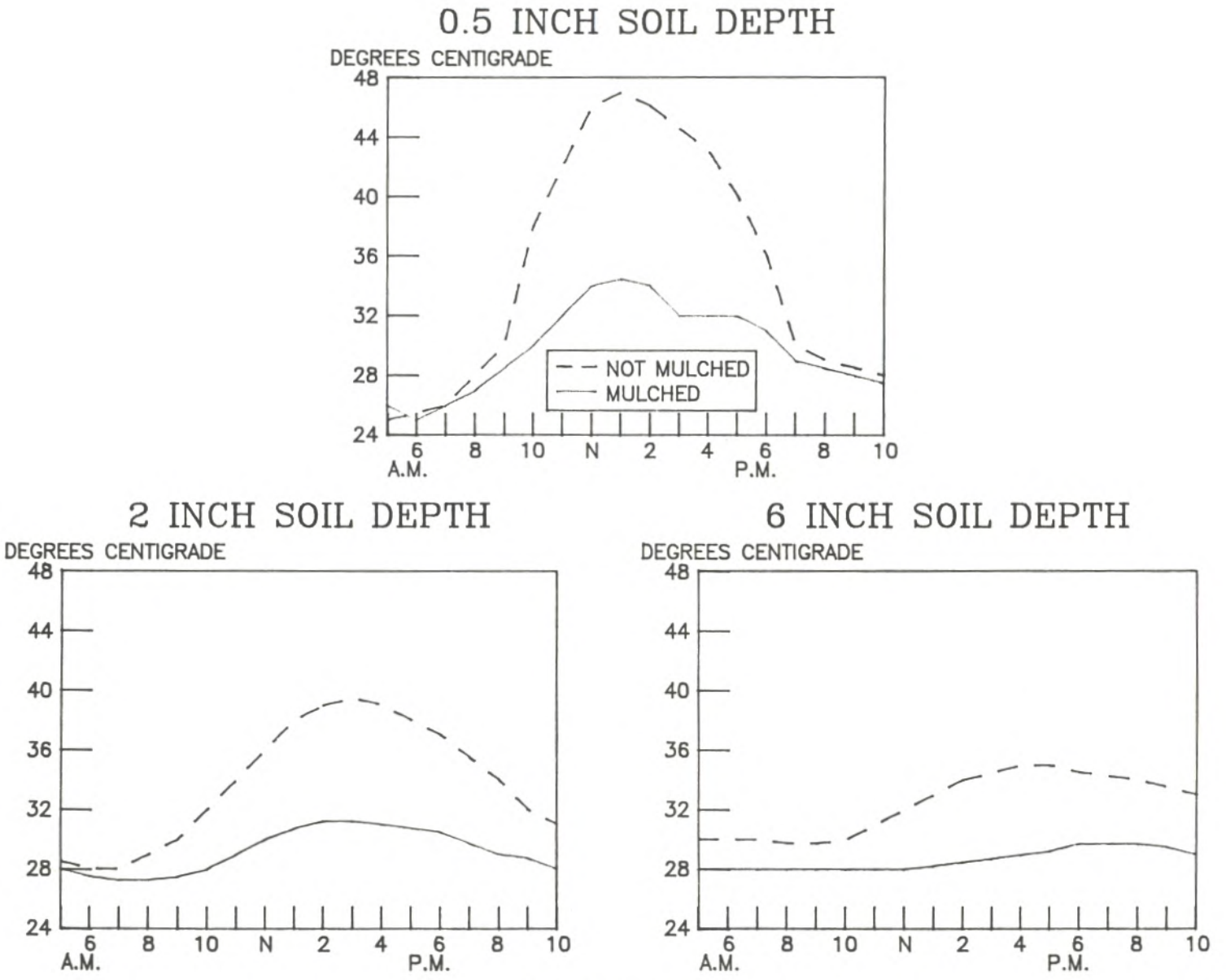


Figure 4. Effect of Sawdust Mulch on Soil Temperature of Cecil Sandy Loam. (Giddens et al 1969)



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