

Some Observations on the Effect of Vertical Mulching

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Vertical mulching is a modification of subsoiling. Research has been under way on vertical mulch at Purdue since 1955. Several popular articles have been published on vertical mulching and considerable interest has been expressed in the practice. The purpose of this paper is to summarize some of the results which have been obtained by several workers and suggest what may be expected from this practice.

To install vertical mulch channels, a subsoiler blade is modified by adding wings that hold the channel open to accommodate the mulch material. Crop residues are blown into the channel by a field chopper which is drawn by the same tractor as is the subsoiler (5). A wheel tractor of three to four plow capacity has been used to pull the entire apparatus when the chopper had its own mounted engine. The channels are generally spaced at 80 inches and are 18 to 20 inches deep.

Vertical mulching has an advantage over subsoiling because the organic matter which is introduced holds the channels open, allowing relatively free passage of moisture and air between the land surface and the subsoil.

Parr (4) found that there was much more earthworm activity adjacent to vertical mulch channels as compared with subsoil channels. Bulk density at 0 to 3 inches from the channel wall and 12 inches below the surface was 1.35 for vertical mulch 14 months after treatment. A similar figure for subsoiling was 1.41, which was significantly higher than on the vertical mulch slots.

Hypothesizing that moisture intake into a soil would be modified both as to rate and pattern under vertical mulch treatment, a pilot study on channels with a 4 percent slope and a free outlet was initiated (1). Conclusions were that where there is a more permeable layer at relatively shallow depths, the channels will discharge water quite readily into the substrata. When the subsoil is saturated, the channels will carry off large amounts of water in excess of that seeping into the subsoil.

In a study on level Fincastle silt loam, sprinkler irrigation was supplied and the pattern of movement of water studied. Moisture resistance units were buried in a grid pattern perpendicular to the vertical mulch channels. A sudden drop in resistance was taken as evidence that the moisture front had reached the location of a resistance unit. An automatic multiple recording device was used to record the readings of the resistance units. The wetting pattern of applied moisture showed that the vertical mulch channels acted to supply water to the subsoil earlier than the water could seep down from the surface of an unmulched soil.

Intake rates were calculated on mulched and unmulched plots. The average intake rates for vertical mulched plots were 1.7 inches per hour, while rates for the unmulched plots were 1.0 inches per hour. Calculations were made on the basis of the amount of infiltration which had occurred

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0.82 hours after onset of irrigation. Patterns of wetting found in the field were quite similar in shape to those found by Swartzendruber (6) using a sand model. A comparison of these patterns can be seen in figures 1 and 2.

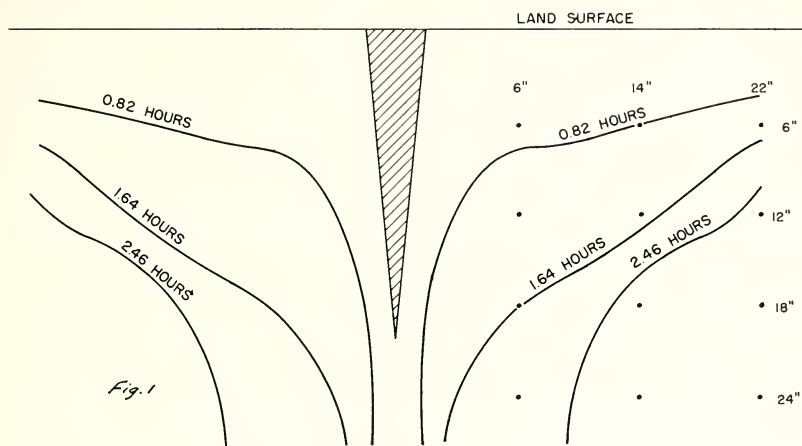


Figure 1. Location of the wetting front in Fincastle silt loam at several times after onset of irrigation (1).

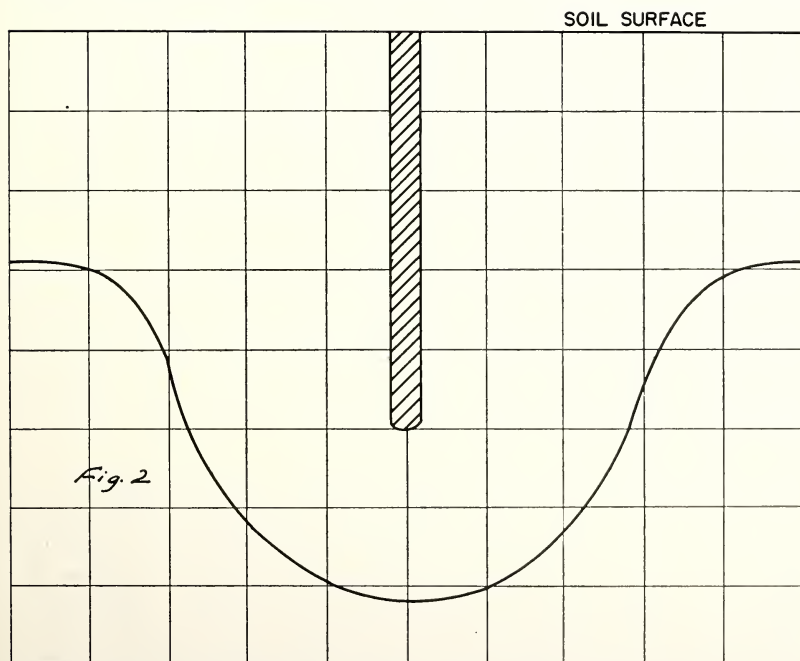


Figure 2. Location of the wetting front in a uniform sand model (6).

Runoff measurements have been made comparing vertical mulch and other treatments on small watersheds at the Purdue Throckmorton Farm. Total runoff is given in table 1 for first and second year channels for the

TABLE 1. The Effect of Tillage on Runoff

Surface	Treatment	Subsoil	Total Runoff in Inches		
			1957 1st year channel	1958 1st year channel	1958 2nd year channel
Plow		None	3.0	4.2	7.3
Field cultivator		None	1.6	7.4	5.3
Plow		Subsoil	0.2	4.0	5.3
Field cultivator		Subsoil	1.0	6.2	6.4
Field cultivator		Vertical mulch	0.2*	5.4**	5.2**

* Channel left open through the year.

** Channel top closed by tillage in the spring.

Data from 3 acre watersheds at Purdue Throckmorton Farm.

years 1957 and 1958. It should be noted that in 1957 the channels were left undisturbed through the growing season by tilling with a field cultivator parallel to the vertical mulch channels. The surface tillage treatment on the watersheds was changed in 1958, making no effort to avoid the vertical mulch channels. It can be seen that the channels were apparently very effective in 1957 when the channels were left open to the surface.

Vertical mulch channels were installed on the Paul Leamon farm in Tippecanoe County in 1956. The soil was a nearly level Fincastle silt loam. Corn yields on the conventionally tilled check plots in 1957 and 1958 were 105 and 97 bushels per acre respectively. Corn that was fertilized in the spring with an application of 100 + 100 + 100 yielded 112 and 103 bushels in 1957 and 1958 respectively. The vertical mulch plots yielded 120 and 119 bushels per acre in those years with the same fertilizer treatment as the spring fertilized plots.

Reports from the Agricultural Research Service, using a rainfall simulator (3) indicate that with the tops of the vertical mulch channels removed by tillage, runoff and soil loss were not reduced below that of the un-subsoiled check area. It was not felt that the rainfall simulator was a completely satisfactory device to evaluate the effectiveness of this type of subsoil treatment, due to the nature of the treatment and the size of the experimental area.

From the foregoing studies it would appear that surface tillage, which removes the tops of the vertical mulch channels, reduces the efficiency of the channels. Apparently, when vertical mulch channels are left open to the surface, they can conduct moisture into the substrata quite effectively. However, when the surface 6 to 8 inches of the channel is removed by tillage, the channels do not fill with water very readily. Under these conditions it can be theorized that the channels will not receive water from the plow layer until the wetting front is somewhat below the tops of the truncated channels. When the surface of the channel is closed, infil-

tration will be necessarily reduced with accompanying increases in runoff and erosion, with respect to the situation with the channel tops open.

Frequently cracks appear through the plow layer directly above the buried vertical mulch channels. It is difficult to predict what effect these cracks may have in allowing water to enter the channels.

To date, most work has been done with channels about 7 feet apart. This spacing is quite satisfactory where vertical mulching is done on pastureland or other noncropland. On cropland however, it is quite difficult to avoid damaging the tops of the channels. In order for vertical mulching to be effective and practical, some means must be developed to conduct farming operations without disturbing the channels. One possibility might be to use a wider channel spacing and limit farming operations to the inter-channel areas. Channel depth would probably have to be increased to maintain effectiveness if spacing were increased.

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