

Chemigation Uniformity

Larry Schwankl

UC Cooperative Extension

Drip Chemigation - General Comments

Do not over-irrigate when injecting.

- **Over-irrigation may leach water soluble chemicals (e.g. nitrates) out of the root zone.**
 - **Once leached, it is no longer available to the plant and it may contaminate the groundwater.**

Drip Chemigation - General Comments

- **The injection point for chemicals should be downstream of the irrigation system filters.**
- **This keeps chemical from going out with the backwash water when the filters are cleaned.**

Drip Chemigation - General Comments

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- This keeps chemical from going out with the backwash water when the filters are cleaned.
- There should be a good screen filter on the line from the injector to the irrigation system.

Solutionizer Injector:



Injection Systems

Solutionizer Machines

Originally designed for injecting gypsum, but now used for fertilizer (e.g. potassium sulfate) injections.

Material is injected as a slurry. It goes into solution after it enters the irrigation system's pipeline

Injection Systems

Solutionizer Machines

Injection point should be upstream of irrigation system filters.

There are contaminants in the gypsum and solid fertilizers which must be filtered out.

Chemigation Uniformity in Drip Irrigation Systems

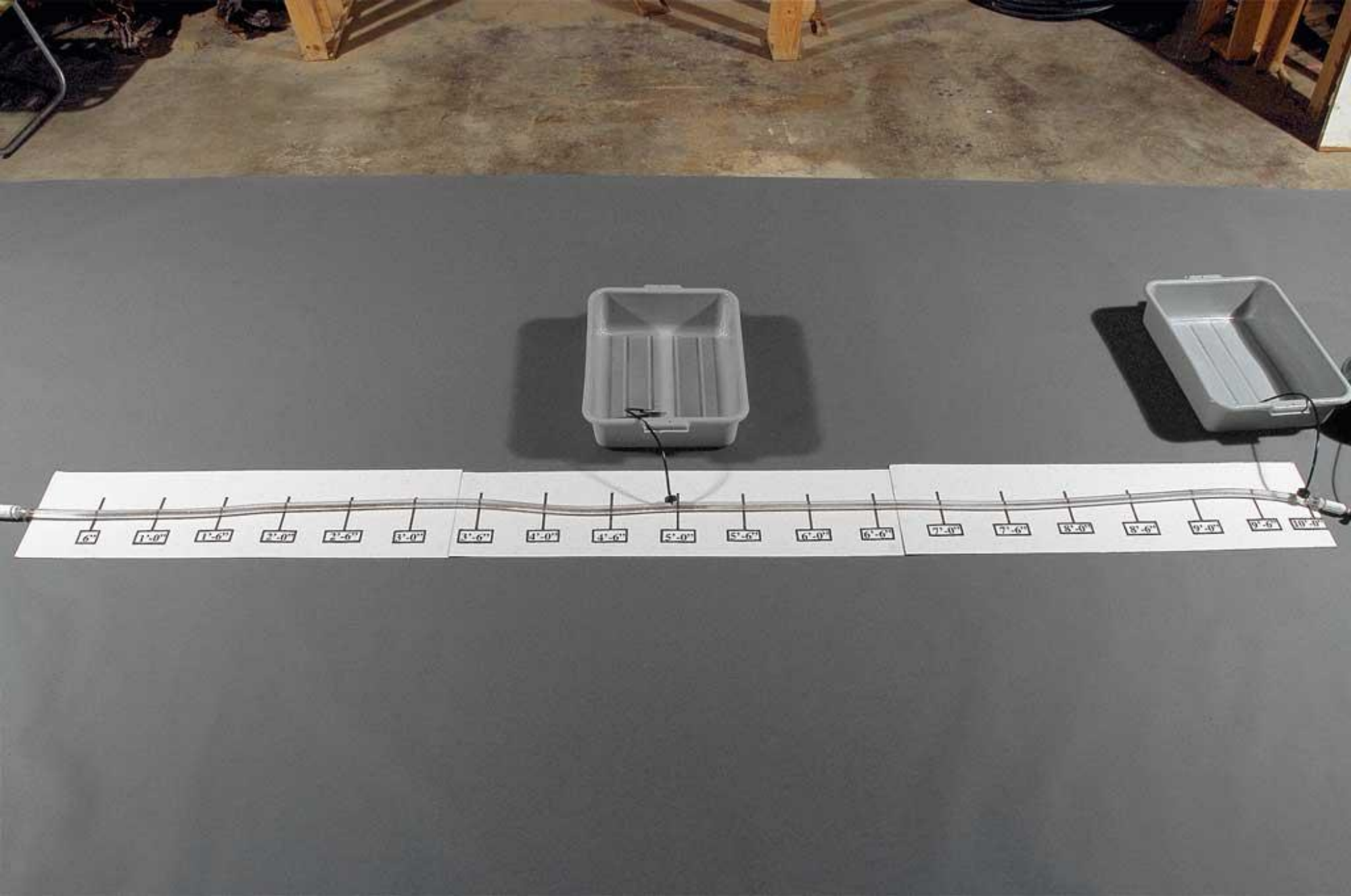
Uniform Chemigation

We want to have the material injected into the drip system to be applied as evenly (uniformly) as the water applied by the drip irrigation system.

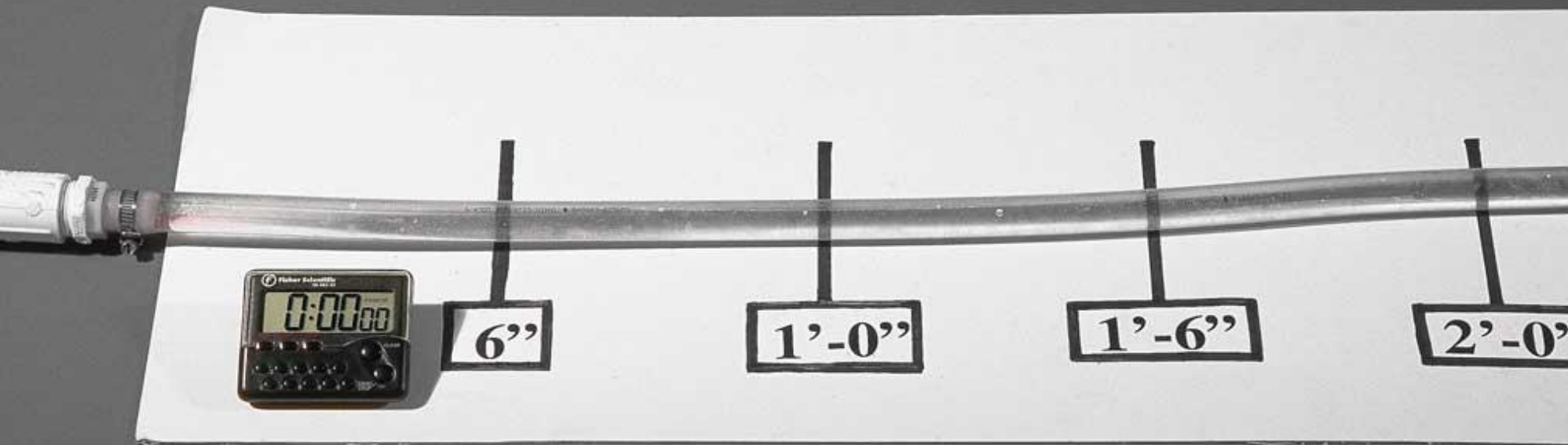
Uniform Chemigation

First, it is important to remember that once you start injecting, the injected material doesn't immediately start coming out of all the drip emitters.

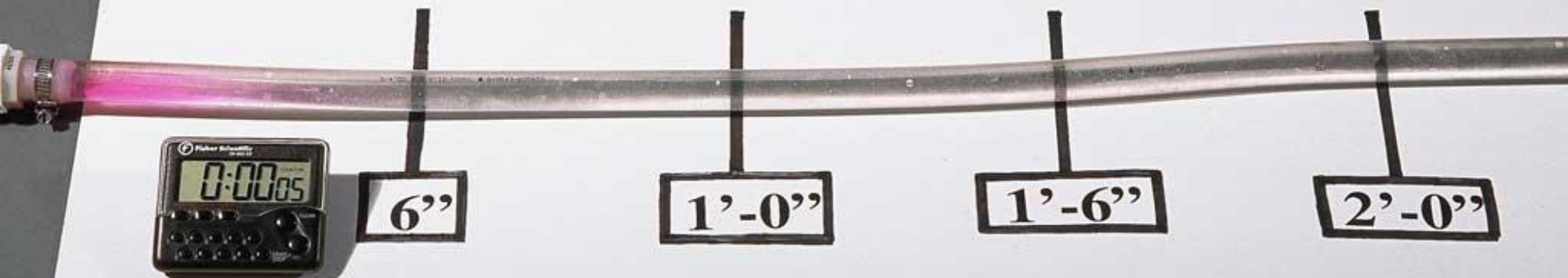
- **It takes time for the injected material (and the water) to travel through the drip irrigation system.**



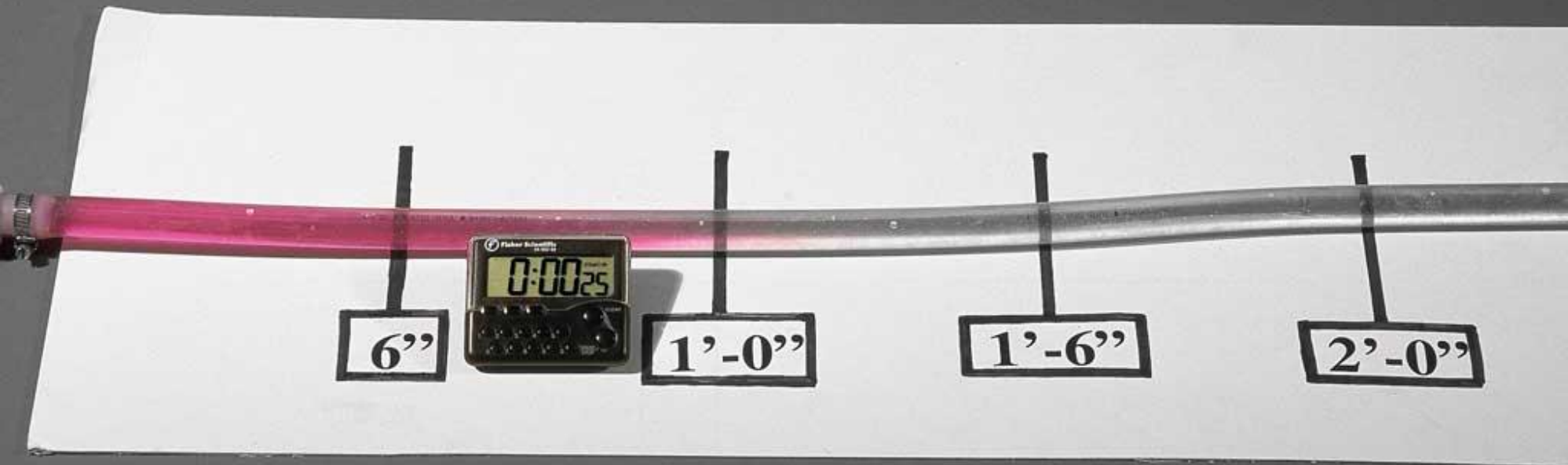
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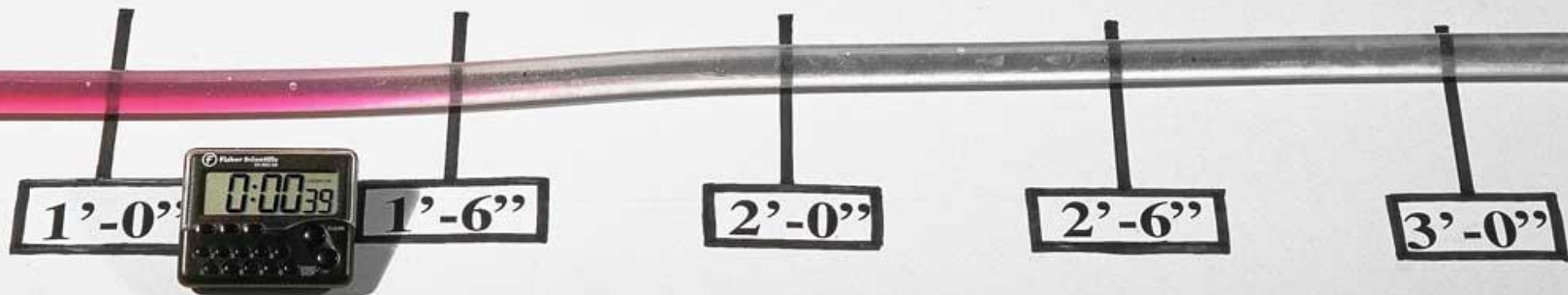
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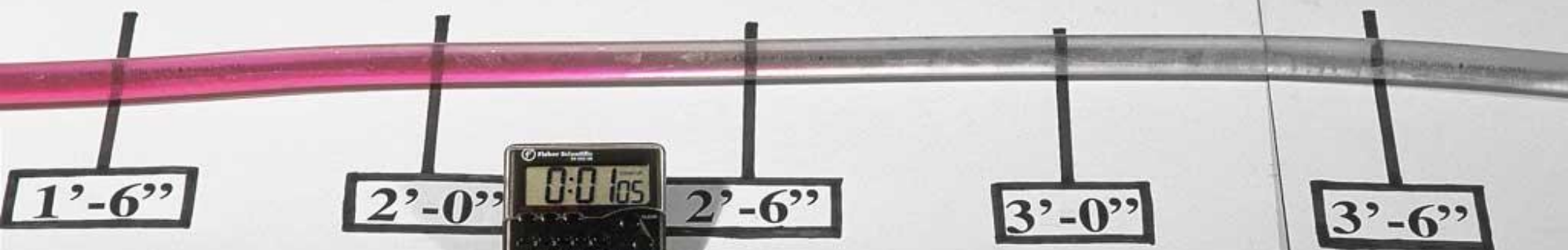
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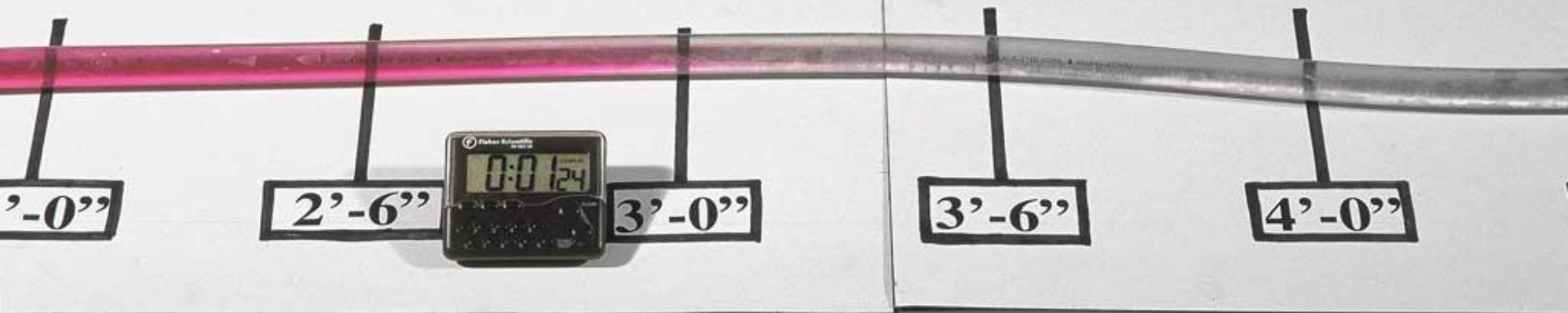
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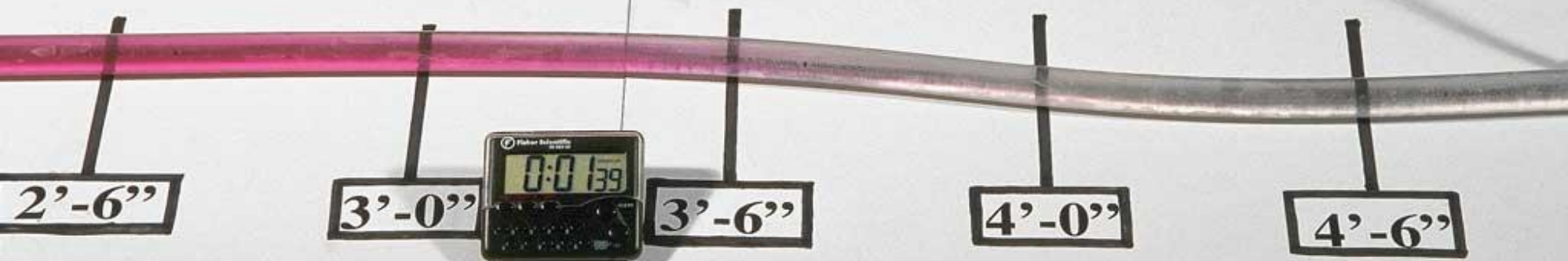
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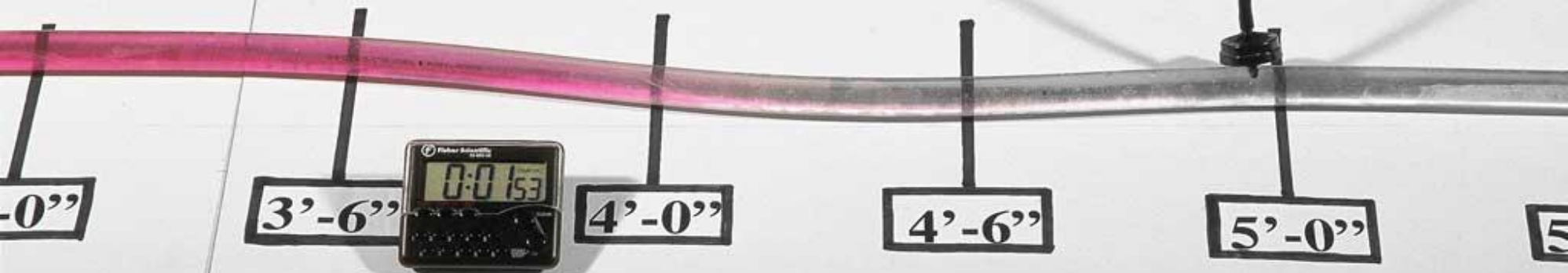
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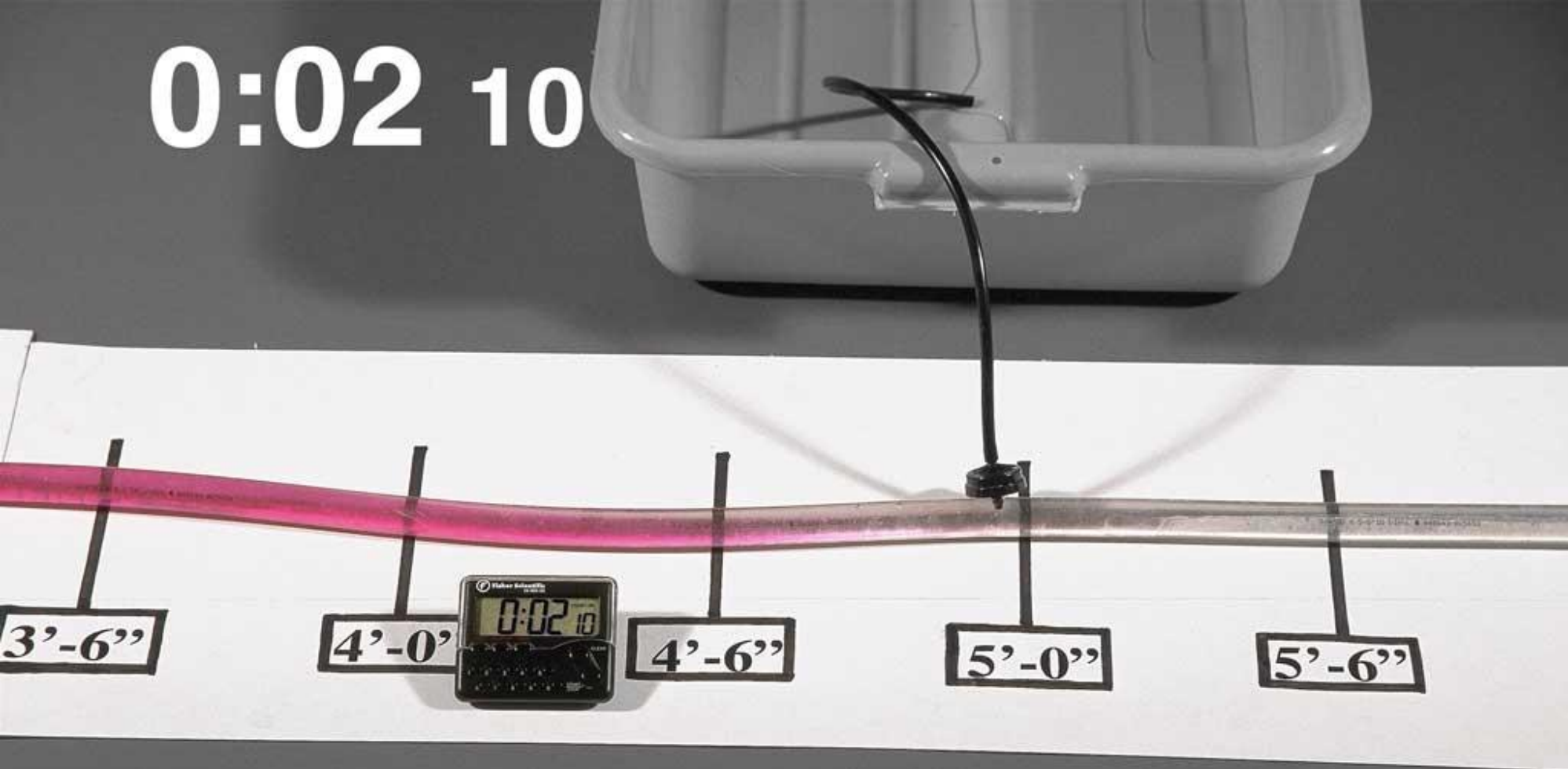
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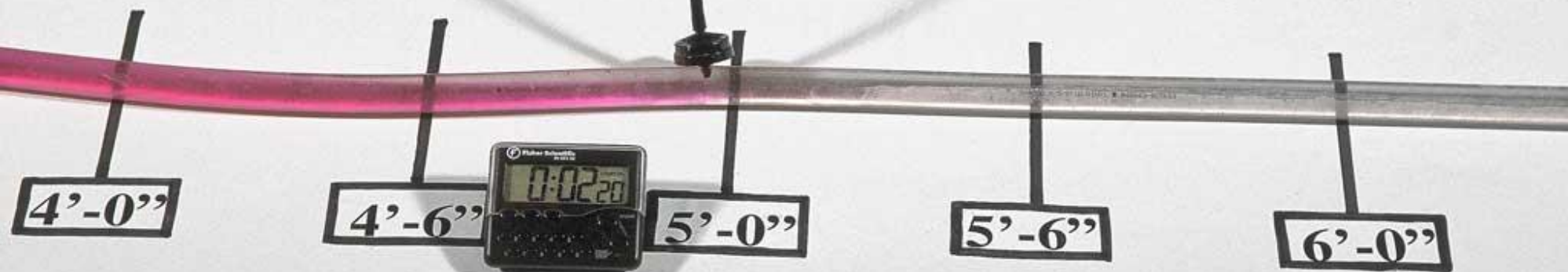
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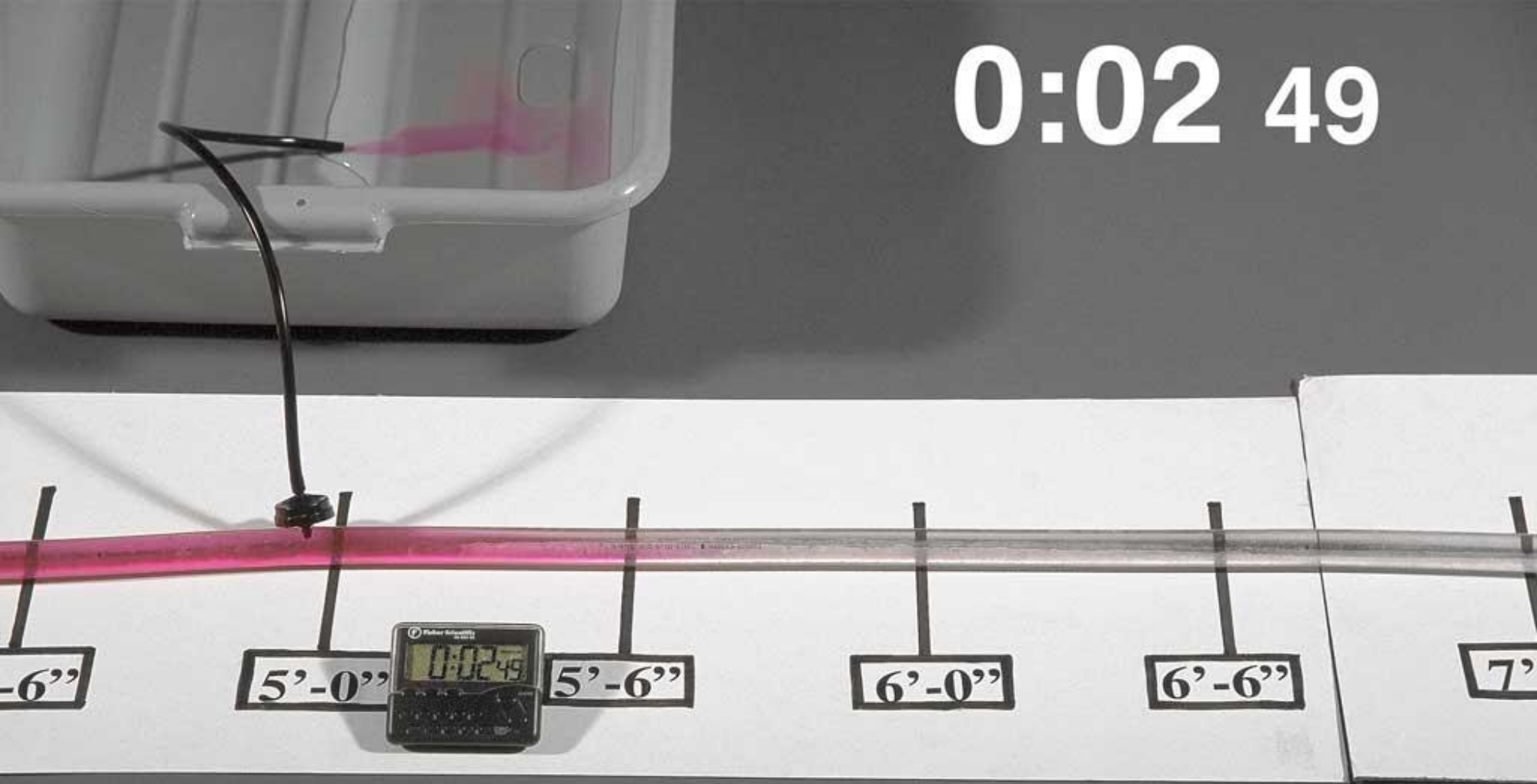
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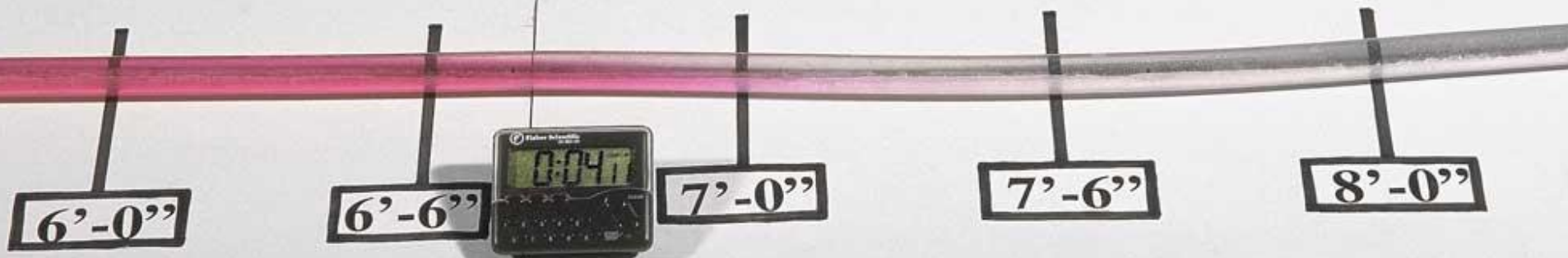
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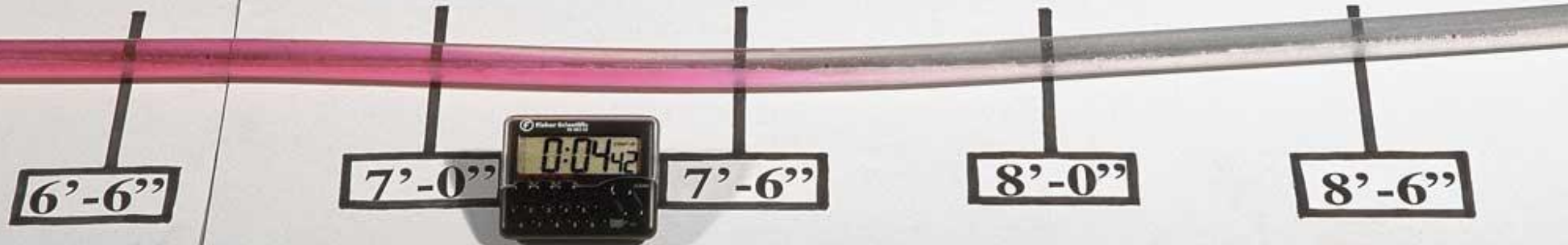
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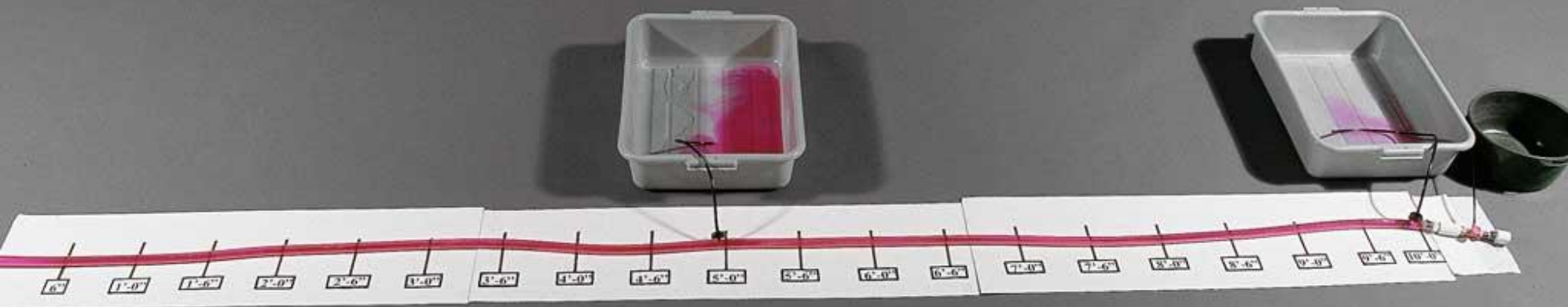


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Uniform Chemigation

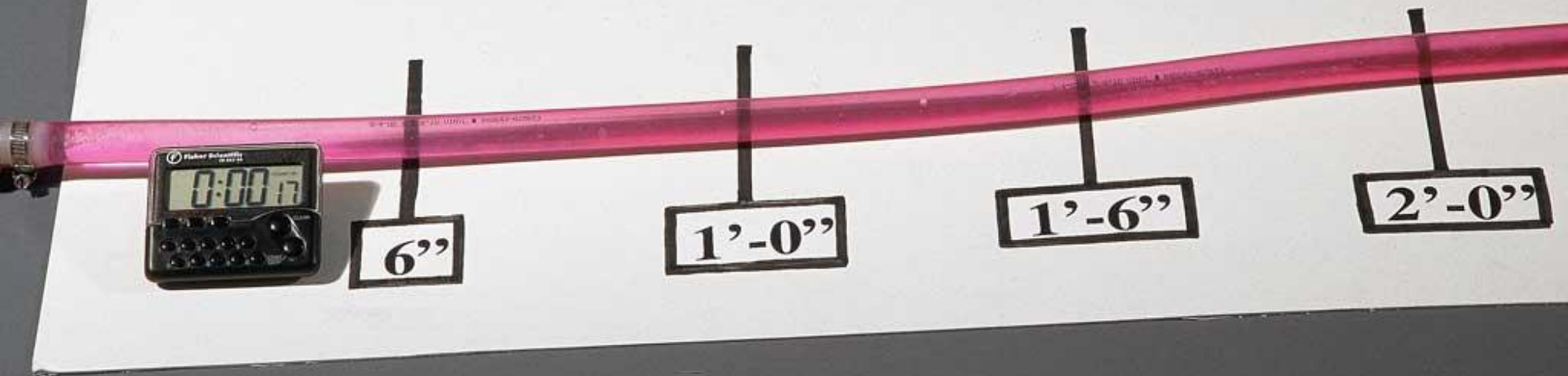
What happens when we stop the injection?

Uniform Chemigation

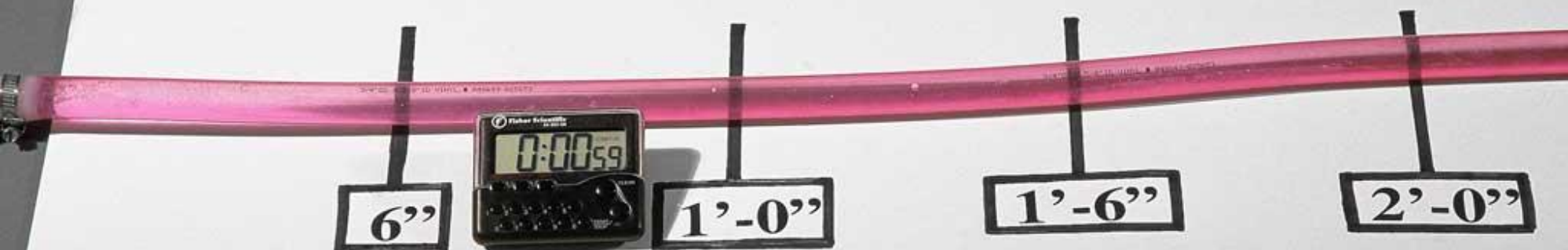
It takes at least as long for most of the chemical to clear from the drip lateral as it took it to initially move through the lateral.

To takes a long time for all the chemical to clear out of the drip lateral.

0:00 17



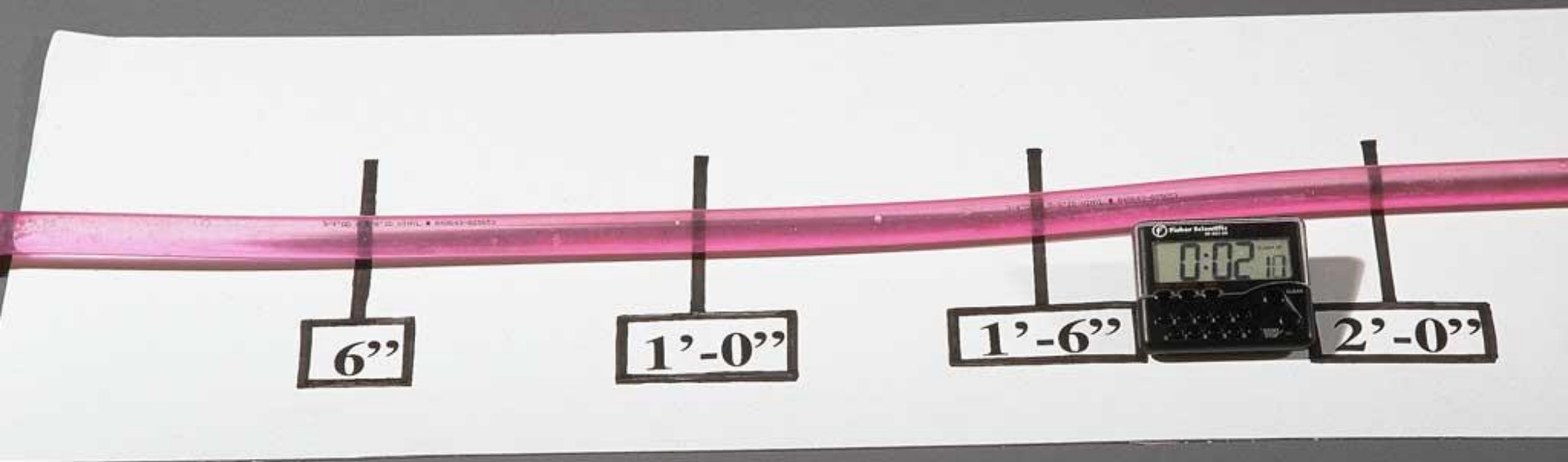
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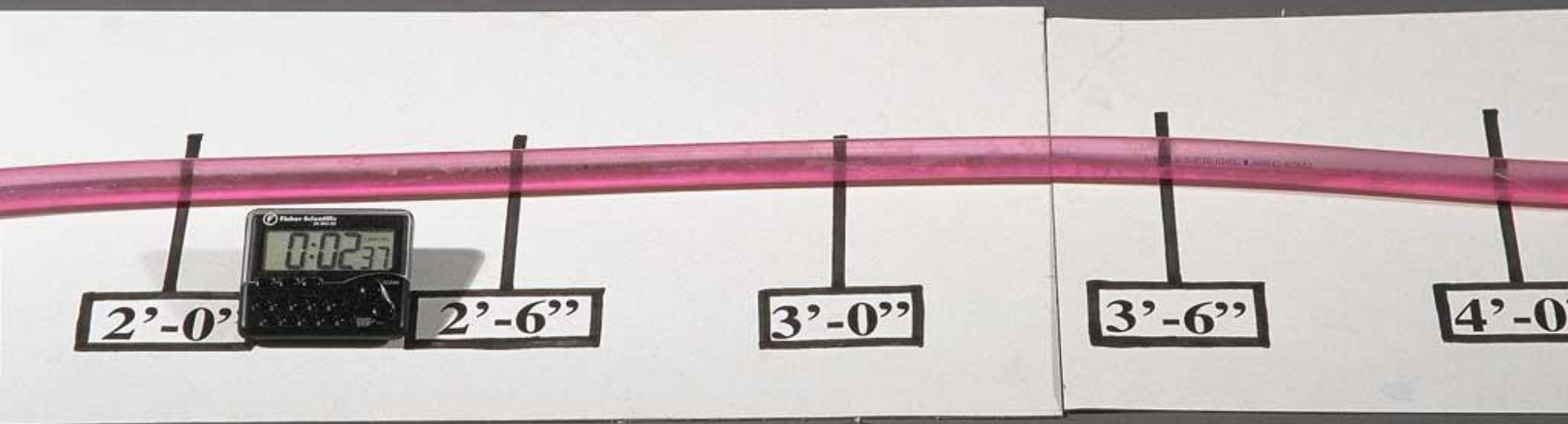
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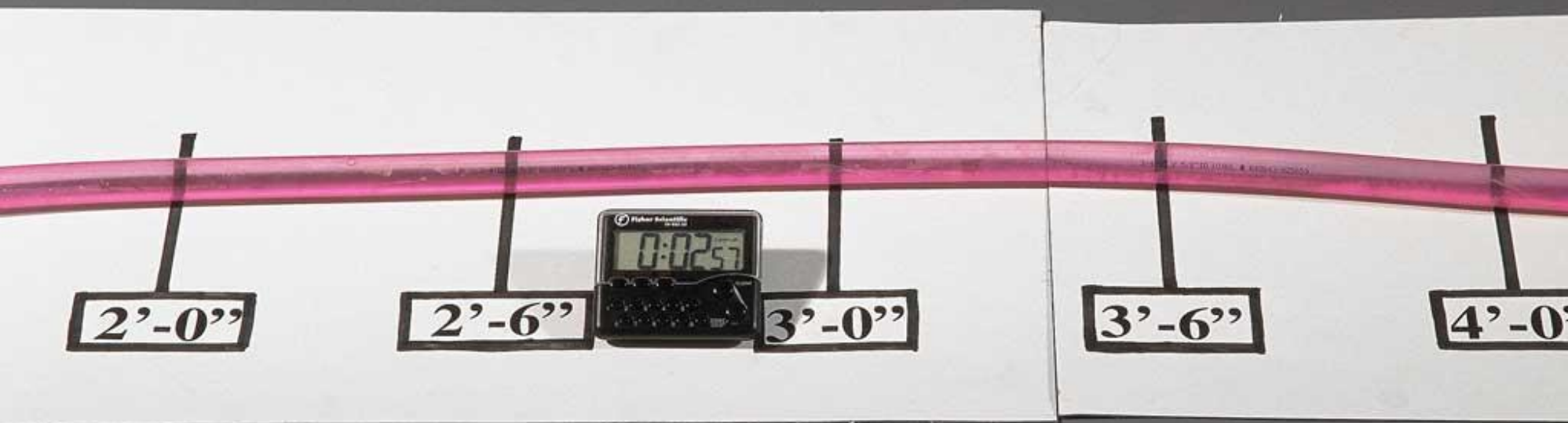
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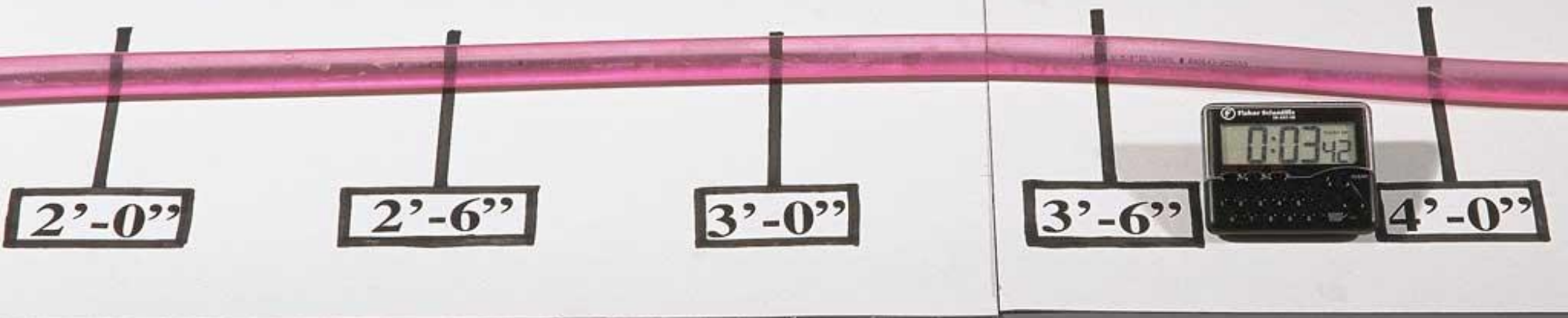
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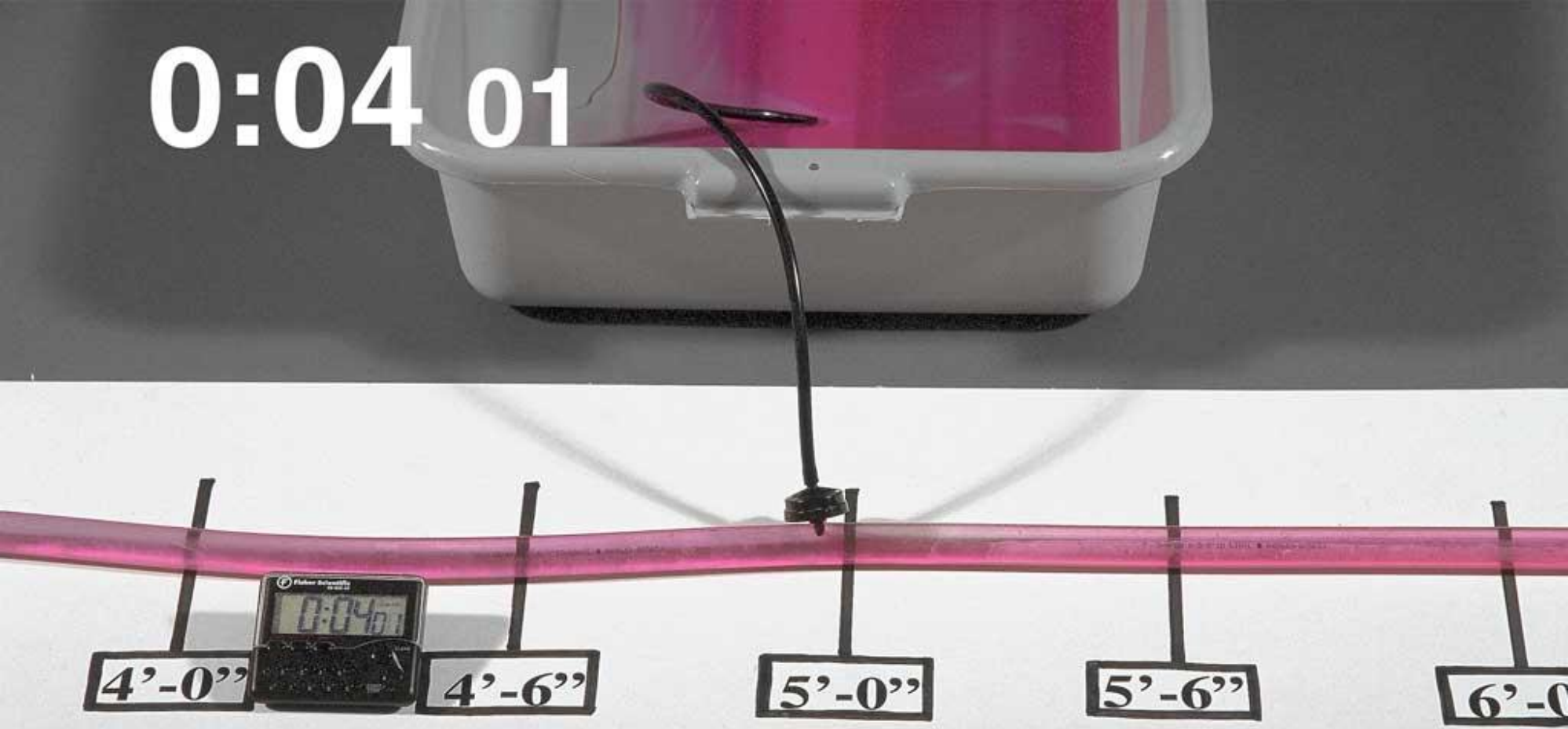
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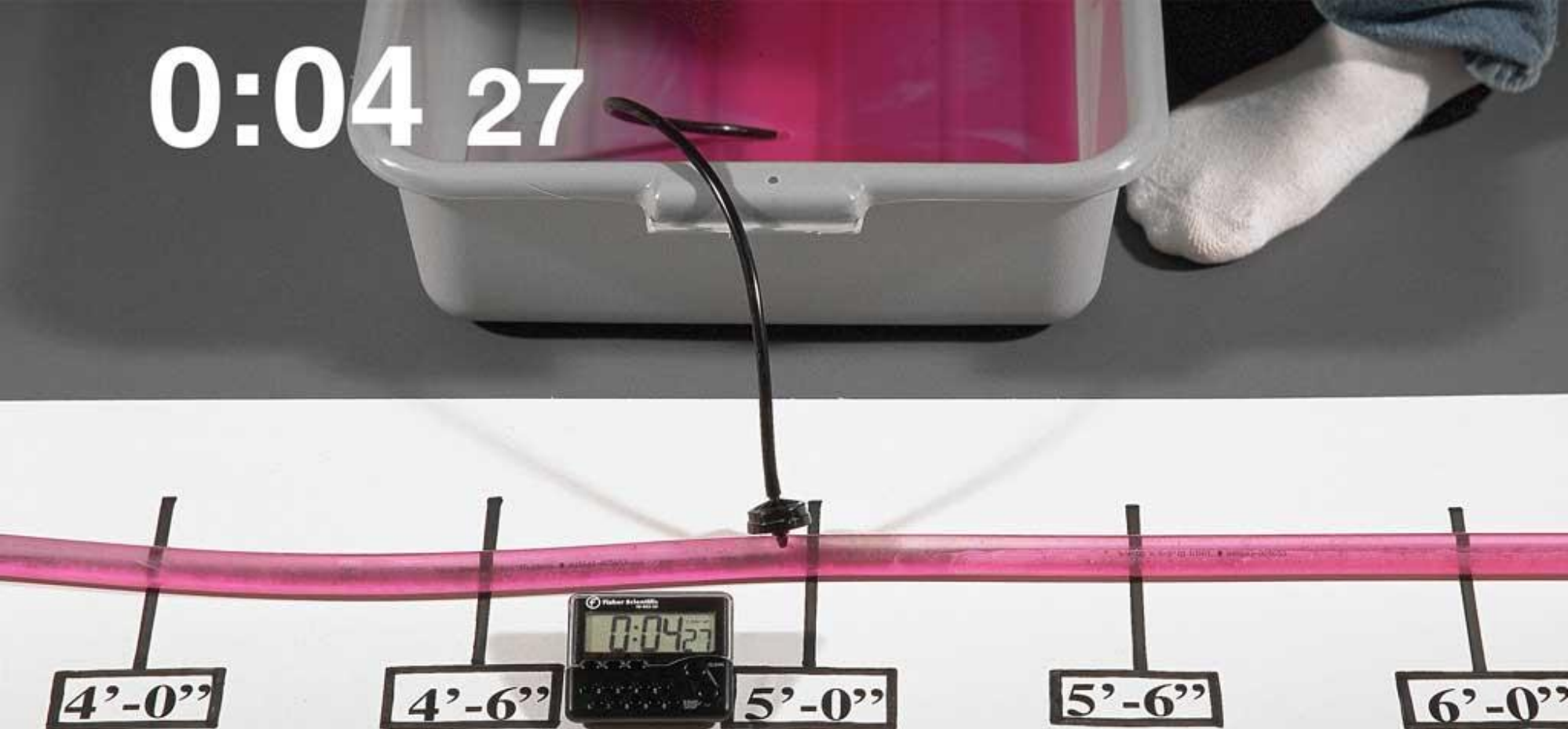
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0:06 19

5'-6"



6'-0"

6'-6"

7'-0"

7'-

0:07 21

5'-6"

6'-0"



6'-6"

7'-0"

7'-6"

0:08 07



0:08 45

5'-6"

6'-0"

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7'-6"

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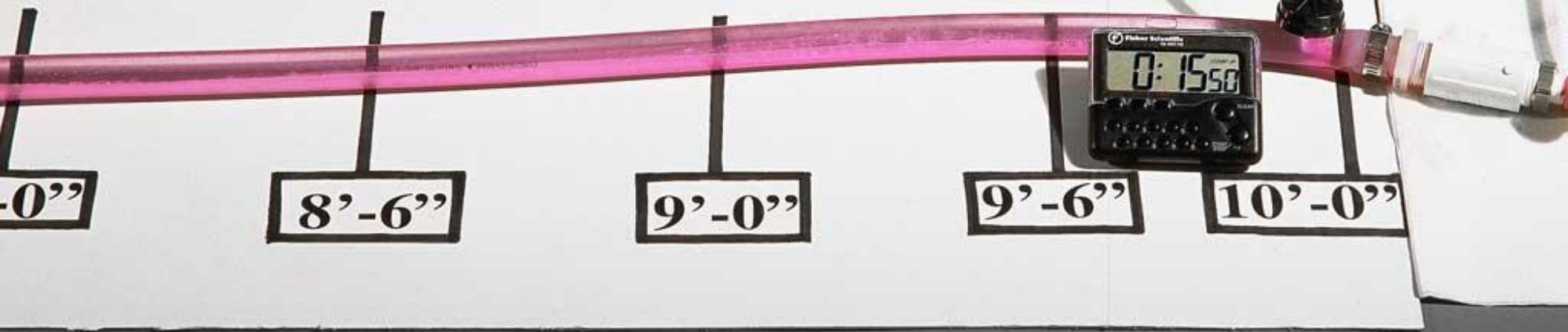
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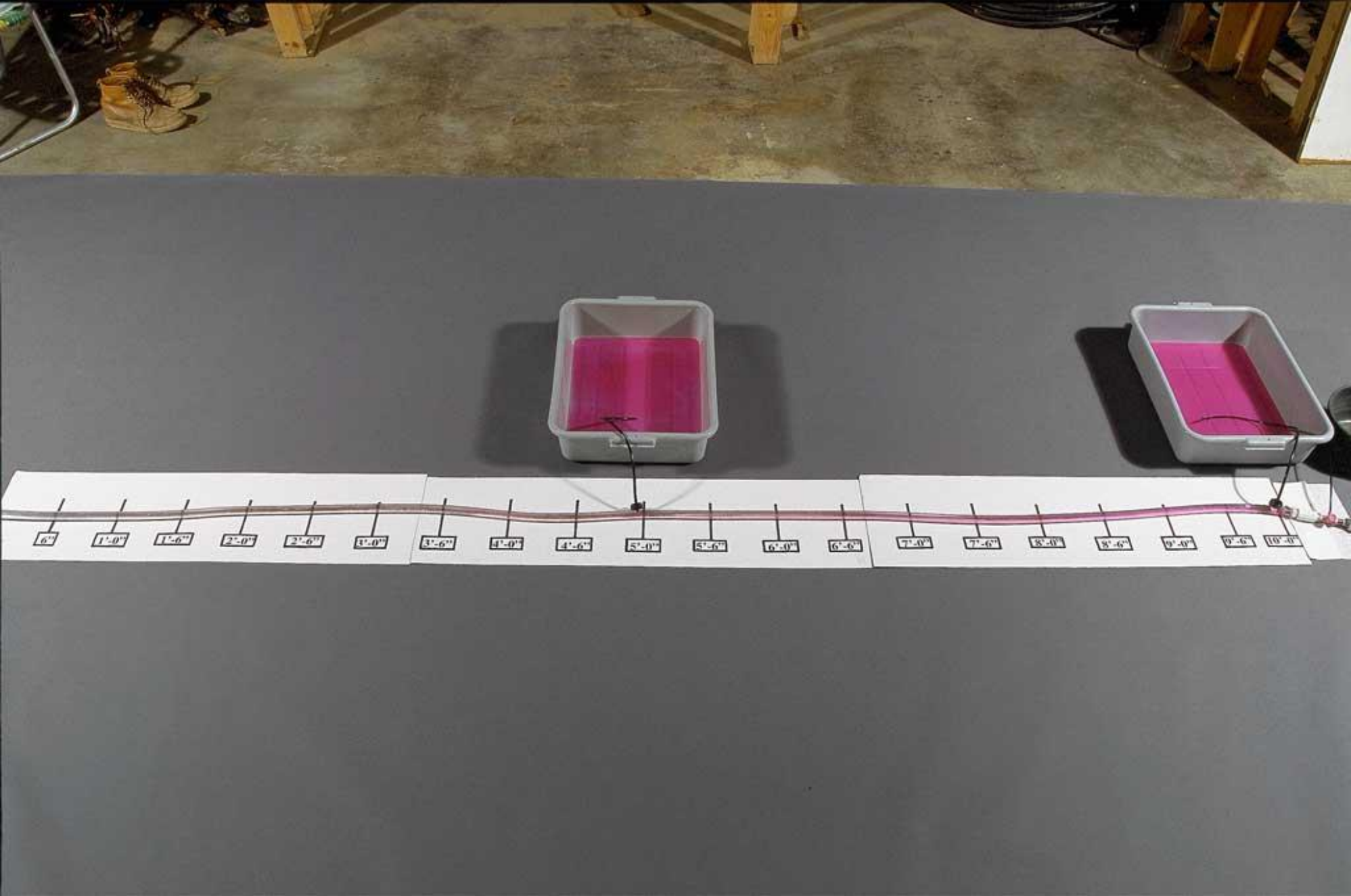


0:13 51



0:15 50





6"-

1'-0"-

1'-6"-

2'-0"-

2'-6"-

3'-0"-

3'-6"-

4'-0"-

4'-6"-

5'-0"-

5'-6"-

6'-0"-

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7'-0"-

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8'-0"-

8'-6"-

9'-0"-

9'-6"-

10'-0"-

Uniform Chemigation

What if you don't have the post-injection period of clean water irrigation?

Chemigation uniformity in a drip lateral (500 ft. long with 1 gallon per hour drip emitters installed at 5 ft. intervals) for various injection time periods and various post-injection clean water irrigations. The water / chemical travel time to reach the end of the drip lateral was 25 minutes.

| Injection Time <u>(min)</u> | Post-Injection Irrigation <u>Time (min)</u> | <u>Relative Uniformity</u> |
|--|--|-----------------------------------|
| 50 | 50 | 100 |
| 50 | 0 | 25 |
| 25 | 25 | 95 |
| 25 | 0 | 11 |
| 13 | 25 | 81 |
| 13 | 0 | 7 |

Uniform Chemigation

We also need to account for the time it takes for the injected chemical to move through the underground pipelines.

How do we do this?

Uniform Chemigation

The easiest way to determine travel times of chemicals (and water) through a drip system:

- Inject chlorine (at about 10 - 20 ppm) into the drip system and follow its movement through the drip system.
- It is easy to spot when chlorine reaches any point by testing the water with a pool/spa test kit.

Uniform Chemigation

What happens during chemigation in a commercial scale vineyard or orchard?

The following table shows the characteristics (pipeline length and drip lateral lengths) and water/chemical travel times for 6 commercial systems.

Water / chemical travel times through the pipelines and drip lateral lines for the vineyard and orchard field sites evaluated.

| <u>Site</u> | <u>Mainline and Submain</u> | | <u>Lateral Line</u> | | <u>Total Travel</u> |
|-------------|-----------------------------|--------------------|---------------------------|--------------------|---------------------|
| | <u>Travel Time (min.)</u> | <u>Length (ft)</u> | <u>Travel Time (min.)</u> | <u>Length (ft)</u> | <u>Time (min)</u> |
| 1 | 22 | 1000 | 10 | 175 | 32 |
| 2 | 30 | 1500 | 10 | 340 | 40 |
| 3 | 65 | 5000 | 10 | 340 | 75 |
| 4 | 15 | 1400 | 30 | 630 | 45 |
| 5 | 8 | 700 | 25 | 625 | 33 |
| 6 | 17 | 800 | 28 | 600 | 45 |

Uniform Chemigation

To get uniform chemigation, you need to have the injection period be long enough to move the chemical through the entire drip system.

and

You need to have a post-injection period of clean irrigation water.

Uniform Chemigation

So what should be our best management practice to get a very uniform injection?

Uniform Chemigation

1. The injection period should be at least as long as it takes water / chemical to move from the head to tail-end of the drip system. Twice as long is better.

Uniform Chemigation

2. The post-injection, clean water irrigation period should be at least as long as it takes water / chemical to move from the head to tail-end of the drip system. Twice as long is definitely better.
 - It takes a long time to completely remove all the injected chemical from the drip system.

DO NOT inject quickly and then shut down the irrigation system.

- This gives you the worst application uniformity.
- Always run clean water after you inject.

Chemigation Uniformity in Drip Irrigation Systems

If you don't want to measure it:

- **Trees & vines** - injections should last at least 1 hour, and at least 1 hour (longer is better) of clean water irrigation should follow it.
- **Row crop drip** - injections should be at least 2 hours in length, and there should be at least 2 hours (longer is better) of clean water irrigation following injection.

Questions?

Larry Schwankl

559-646-6569

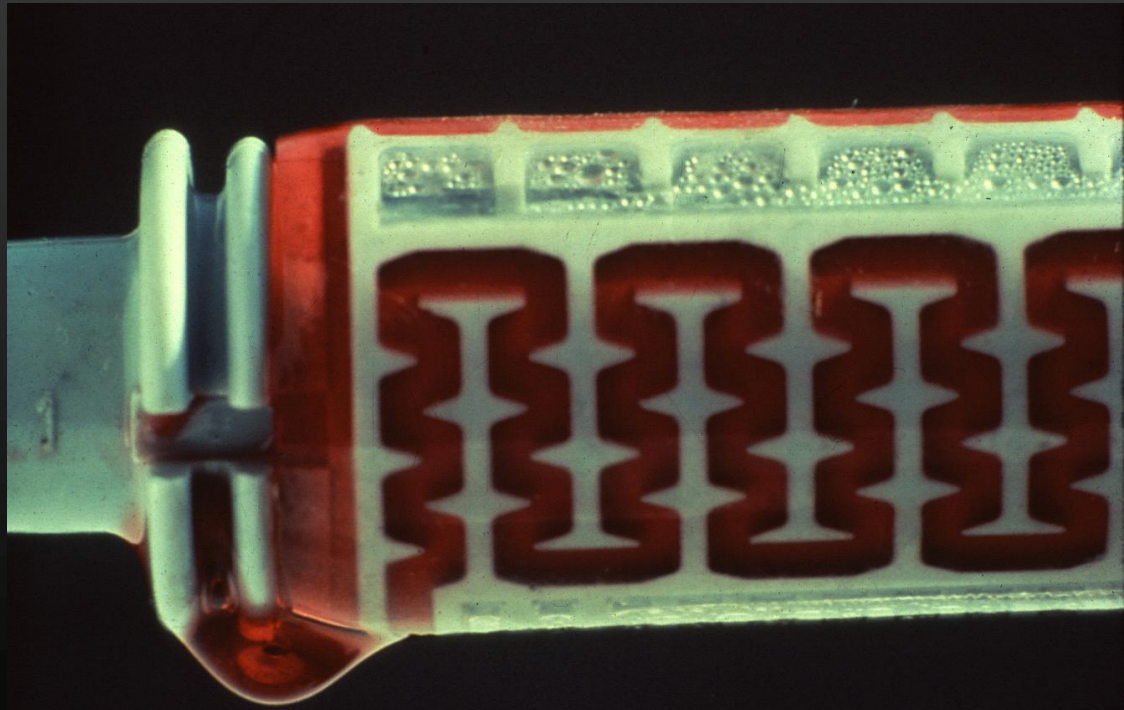
e-mail: schwankl@uckac.edu

For Powerpoint presentation, go to:

<http://schwankl.uckac.edu>

Chemigation Uniformity in Drip Irrigation Systems

CLOGGING of a microirrigation system can also lead to chemigation non-uniformity.



Microirrigation Systems - Clogging

Chemical Precipitate Clogging

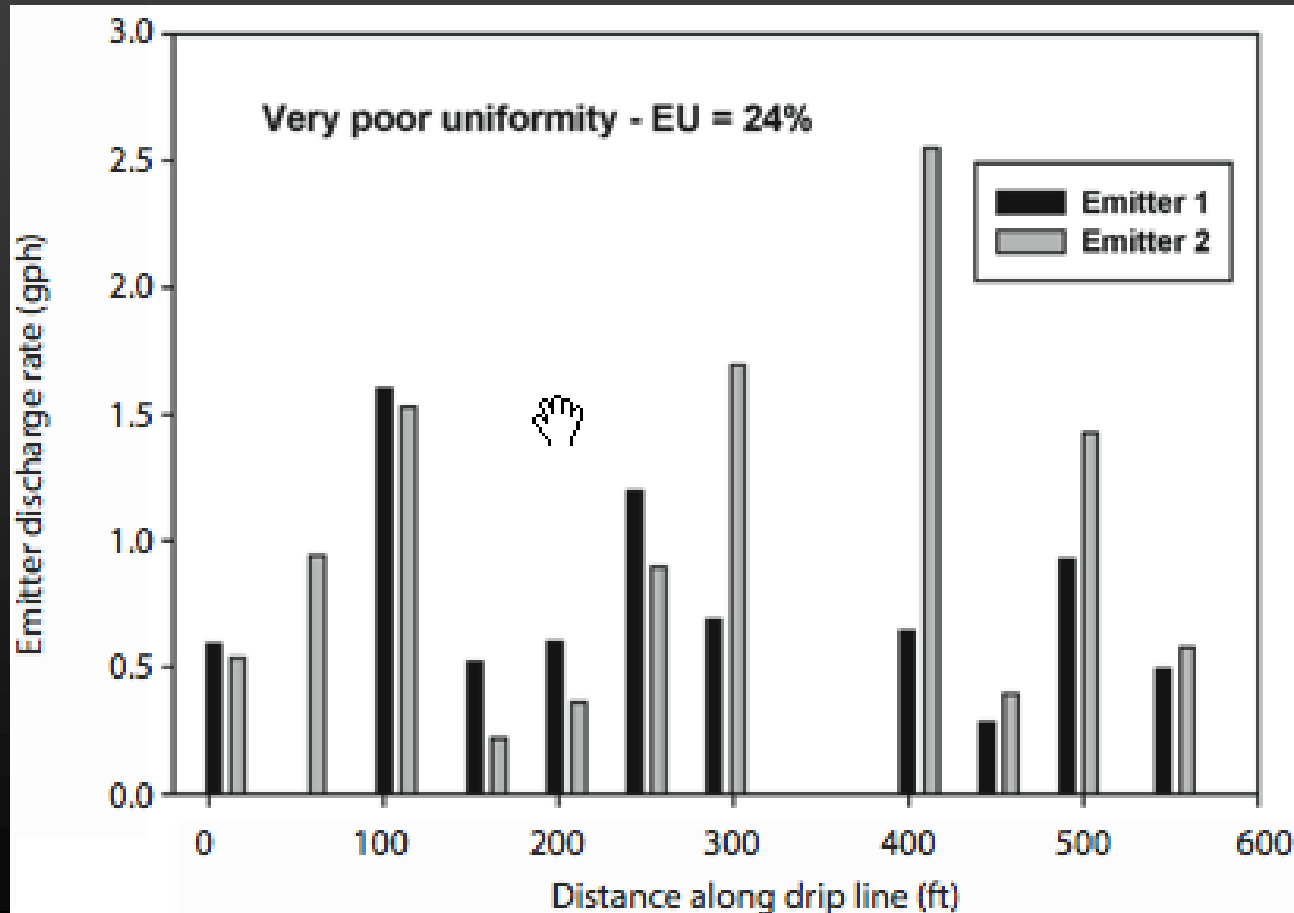


Figure 4. Iron and calcium carbonate precipitation greatly reduced emitter discharge uniformity along the drip line. The design emitter discharge rate was 0.5 gph. The discharge rates of two adjacent emitters (emitter 1 and emitter 2) were determined at each measurement location along the lateral.

Microirrigation Systems - Clogging

Chemical Precipitate Clogging - General Cautions

1. Injecting something which increases the water pH can be a hazard.

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Chemical Precipitate Clogging - General Cautions

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2. Injected chemicals which contain calcium, sulfide, or phosphate can be a hazard.
3. Mixing chemicals to be injected can be an adventure.

Microirrigation Systems - Clogging

Chemical Precipitate Clogging - General Cautions

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When in doubt, use the JAR TEST

Microirrigation Systems - Clogging

Particulate Clogging - General Cautions

FilterFilter..... Filter



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