

Protecting Dry Lumber

Bob Little



The Problem

- ❖ Hardwood lumber is normally dried to 6 – 8% MC
- ❖ Most lumber is stored in unconditioned buildings
- ❖ EMC of air in the eastern US is 12 – 13%
- ❖ Over time lumber MC will rise until it reaches equilibrium with the EMC of the surrounding air

Typical Dry Lumber Storage



US EMCs

State	Spring ¹		Summer ¹		Fall ¹		Winter ¹	
	Average EMC ²	Designation ³	Average EMC ²	Designation ³	Average EMC ²	Designation ³	Average EMC ²	Designation ³
	<i>Pct</i>		<i>Pct</i>		<i>Pct</i>		<i>Pct</i>	
New Hampshire	12.2	Moist	11.1	Moist	14.5	Damp	13.6	Damp
New Jersey	11.8	.. do ..	12.0	.. do ..	12.8	Moist	12.7	Moist
New Mexico	9.0	Dry	7.9	Arid	9.3	Dry	10.1	Dry
New York	13.1	Damp	12.8	Moist	14.1	Damp	14.8	Damp
	<i>Pct</i>		<i>Pct</i>		<i>Pct</i>		<i>Pct</i>	
North Carolina	13.3	Damp	14.8	Damp	14.7	Damp	13.2	Damp
North Dakota	11.4	Moist	11.3	Moist	13.2	.. do ..	13.6	do.
Ohio	12.9	.. do ..	13.4	Damp	14.0	.. do ..	15.2	Wet
Oklahoma	14.6	Damp	12.6	Moist	13.3	.. do ..	14.3	Damp
Oregon								
Coastal	14.7	.. do ..	12.4	.. do ..	14.9	.. do ..	18.7	Wet
Inland	11.9	Moist	8.1	Dry	9.6	Dry	16.0	do.
Pennsylvania	12.5	.. do ..	12.7	Moist	13.6	Damp	13.3	Damp
Puerto Rico								
Windward	14.9	Damp	15.7	Wet	16.0	Wet	15.5	Wet
Rhode Island	12.4	Moist	13.4	Damp	13.6	Damp	12.7	Moist
South Carolina	13.8	Damp	14.6	.. do ..	14.6	.. do ..	13.5	Damp
South Dakota	12.4	Moist	11.7	Moist	11.7	Moist	12.8	Moist
Tennessee	13.3	Damp	13.7	Damp	14.2	Damp	13.8	Damp
Texas								
Coastal	15.1	Wet	14.2	.. do ..	16.1	Wet	15.5	Wet
Inland	12.0	Moist	10.2	Dry	12.5	Moist	12.3	Moist
Utah	10.1	Dry	7.2	Arid	9.7	Dry	13.9	Damp
Vermont	12.0	Moist	12.7	Moist	14.2	Damp	14.0	do.
Virginia	12.9	Moist	13.9	Damp	14.0	Damp	12.2	Moist
Washington								
Coastal	14.2	Damp	13.8	.. do ..	15.7	Wet	17.0	Wet
Inland	11.6	Moist	9.6	Dry	12.5	Moist	17.9	do.
West Virginia	11.8	.. do ..	13.5	Damp	12.7	.. do ..	12.1	Moist
Wisconsin	13.2	Damp	13.5	.. do ..	14.5	Damp	14.6	Damp
Wyoming	12.1	Moist	9.7	Dry	10.8	Dry	11.5	Moist

¹ Spring is March, April, and May; summer is June to August; fall is September, October, and November; and winter is December, January, and February.



The Specification

Lumber must be below 10% MC to be allowed into production

The Question



How long can 4/4 red oak lumber sit in dry storage before it reaches 10%

The Study

- ❖ Test conducted in central Arkansas
- ❖ Test begun in late July
- ❖ MCs of boards in 10 packs of stickered and 10 packs of dead packed lumber were measured using an electric moisture meter
- ❖ Meter readings were taken on every board on the 5th, 10th, 15th, and 20th layers of test packs



The Study

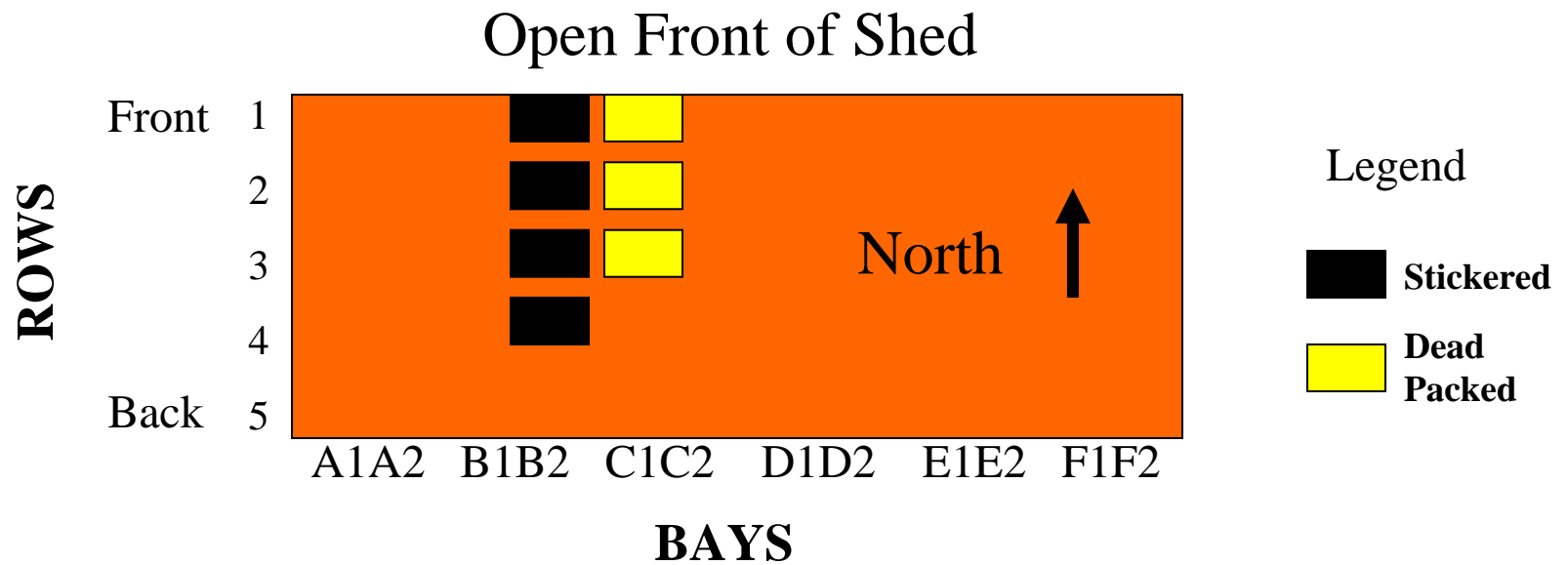
- All measurements taken 18" from board ends
- Readings were written on the boards at measurement points



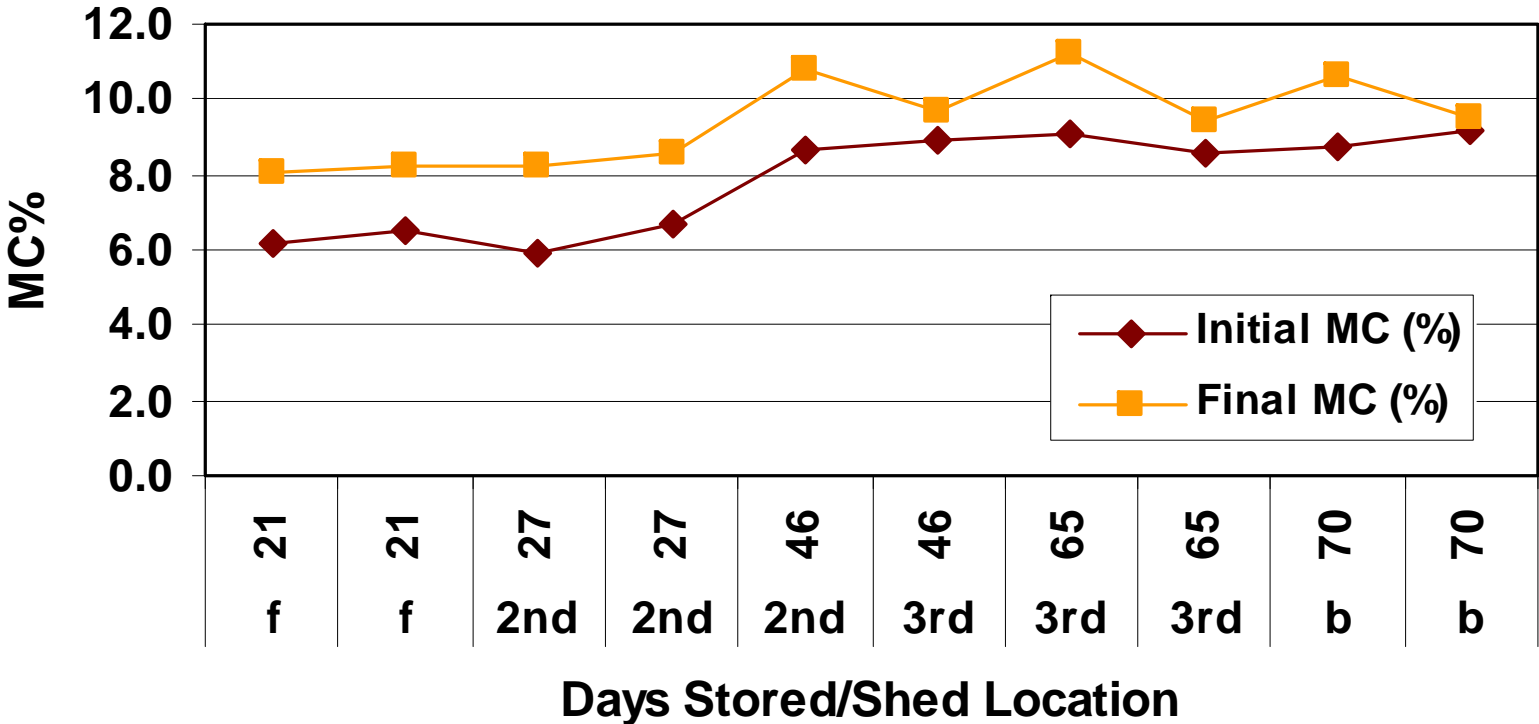
The Study

- ❖ All packs were placed into dry storage at the same time
- ❖ As the packs went to production, the same boards were remeasured using the same meter at the same locations
- ❖ Last lumber run in early November

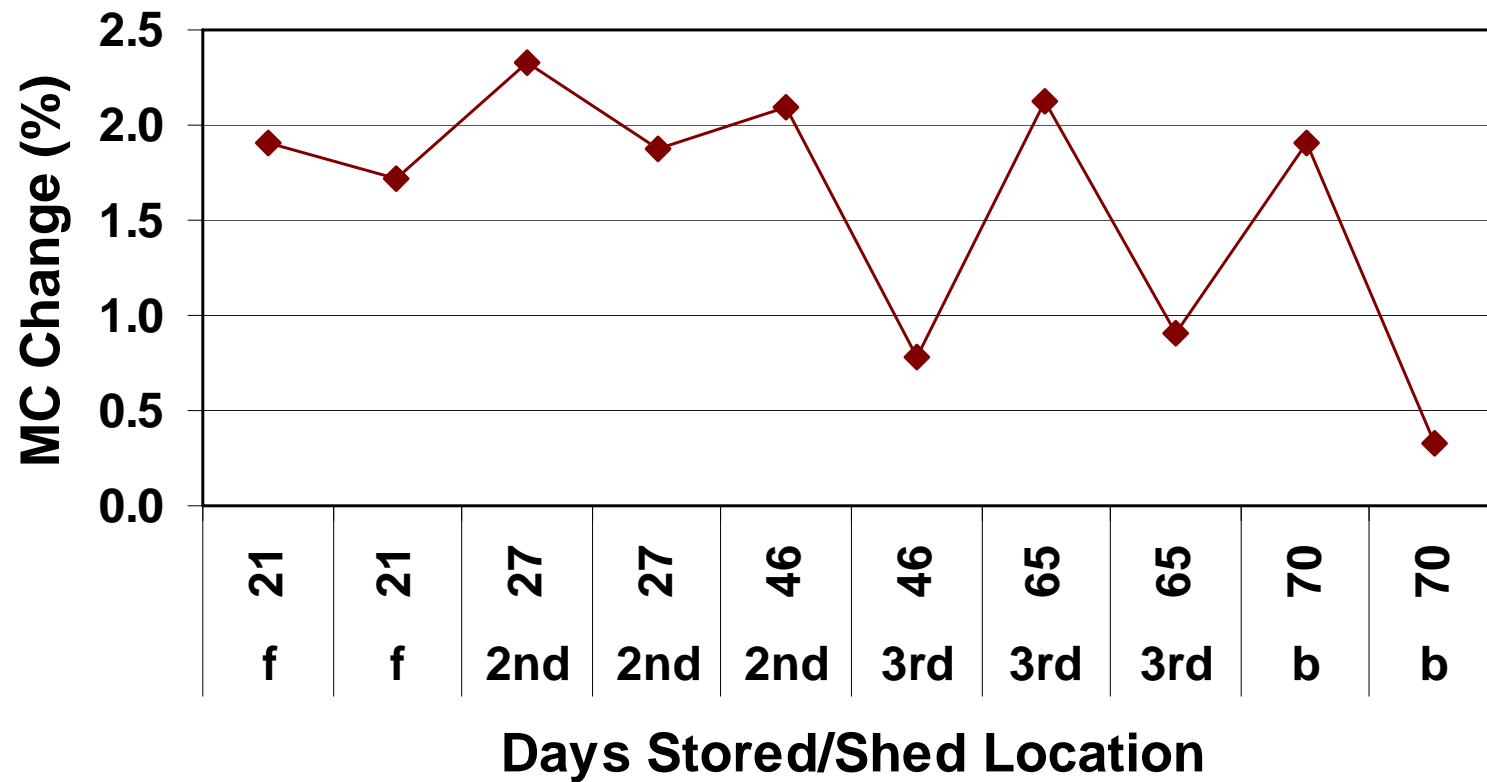
Shed Locations



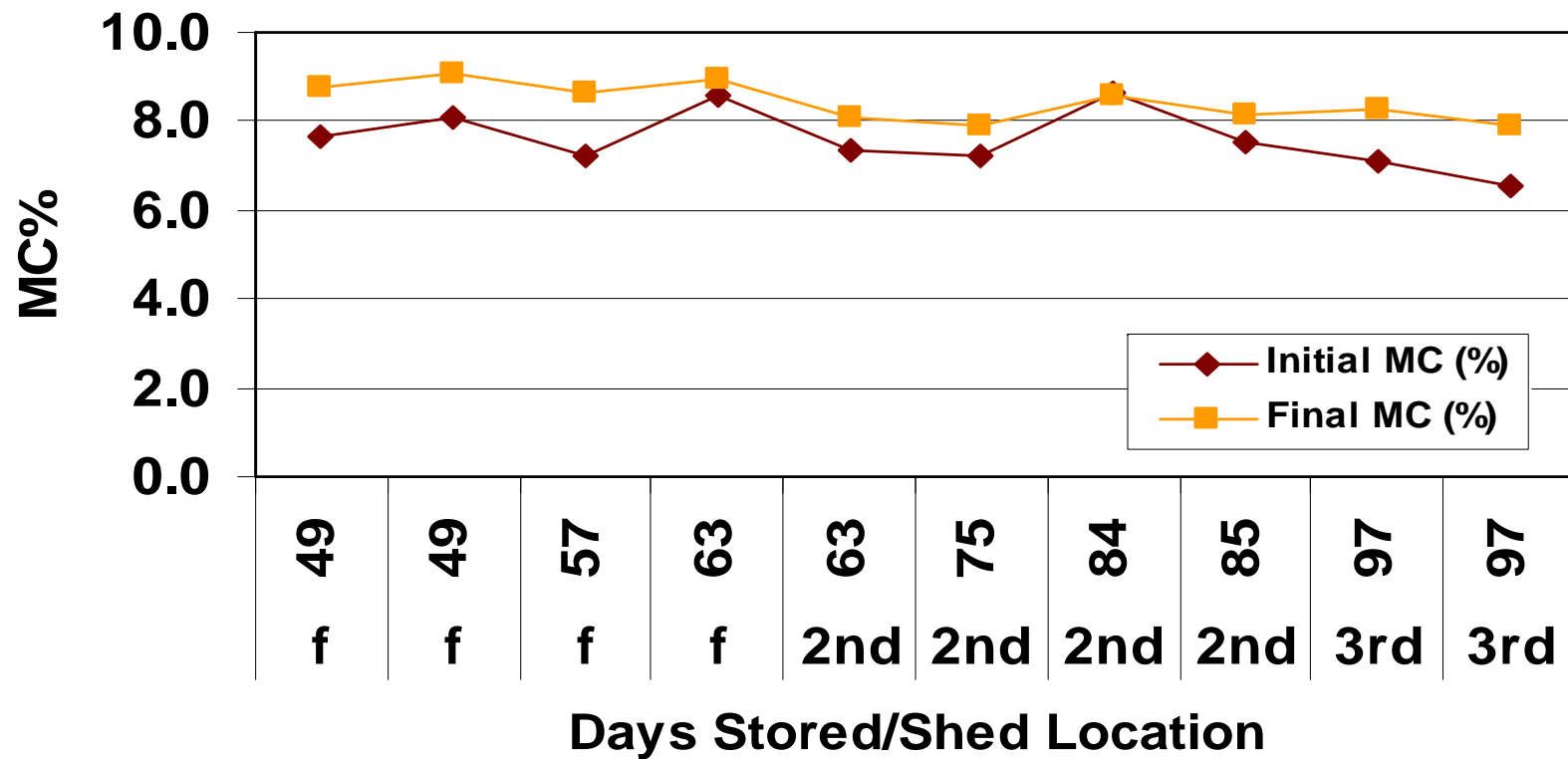
MC of Stickered Lumber



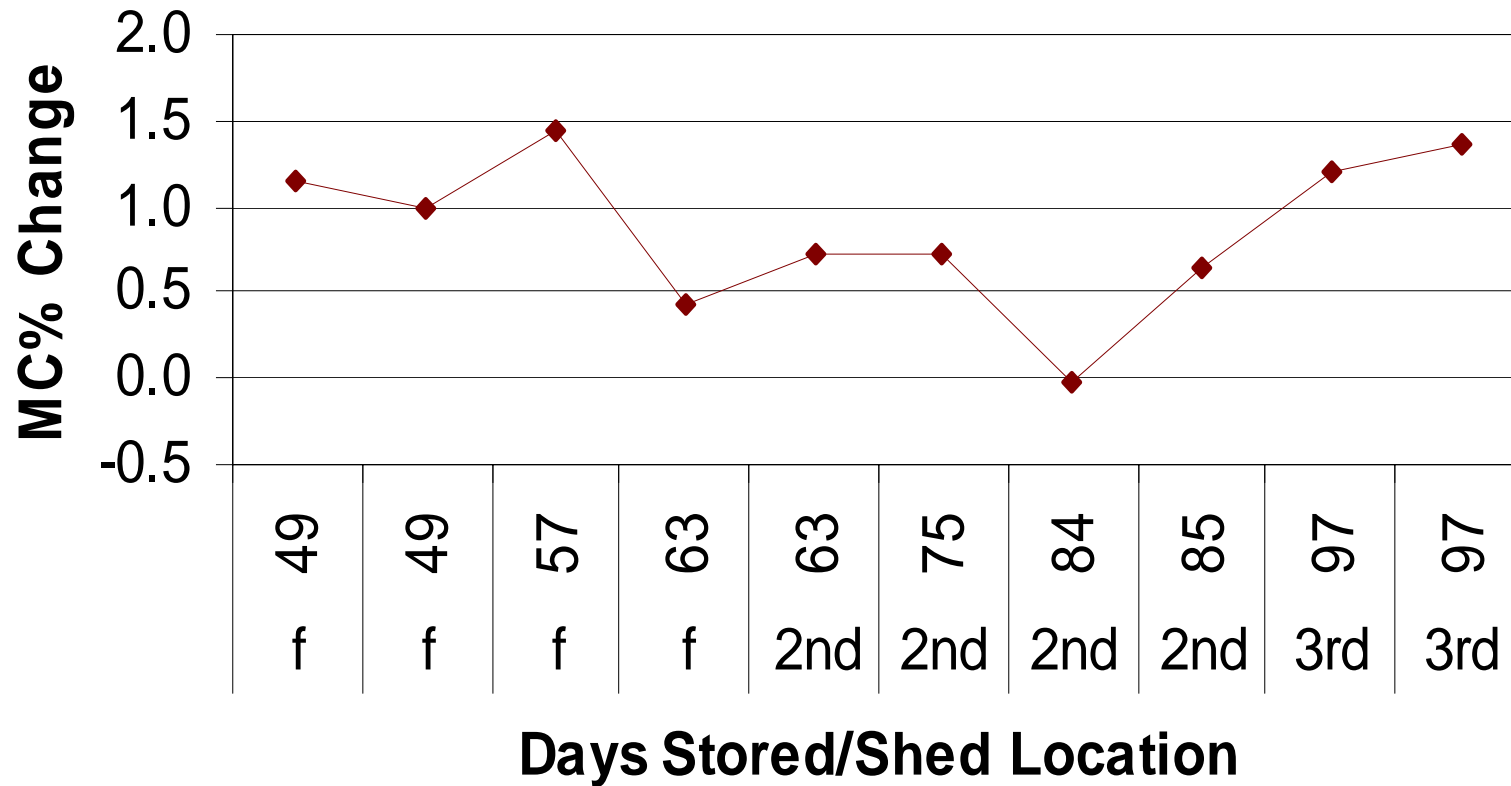
Stickered Lumber MC Gain



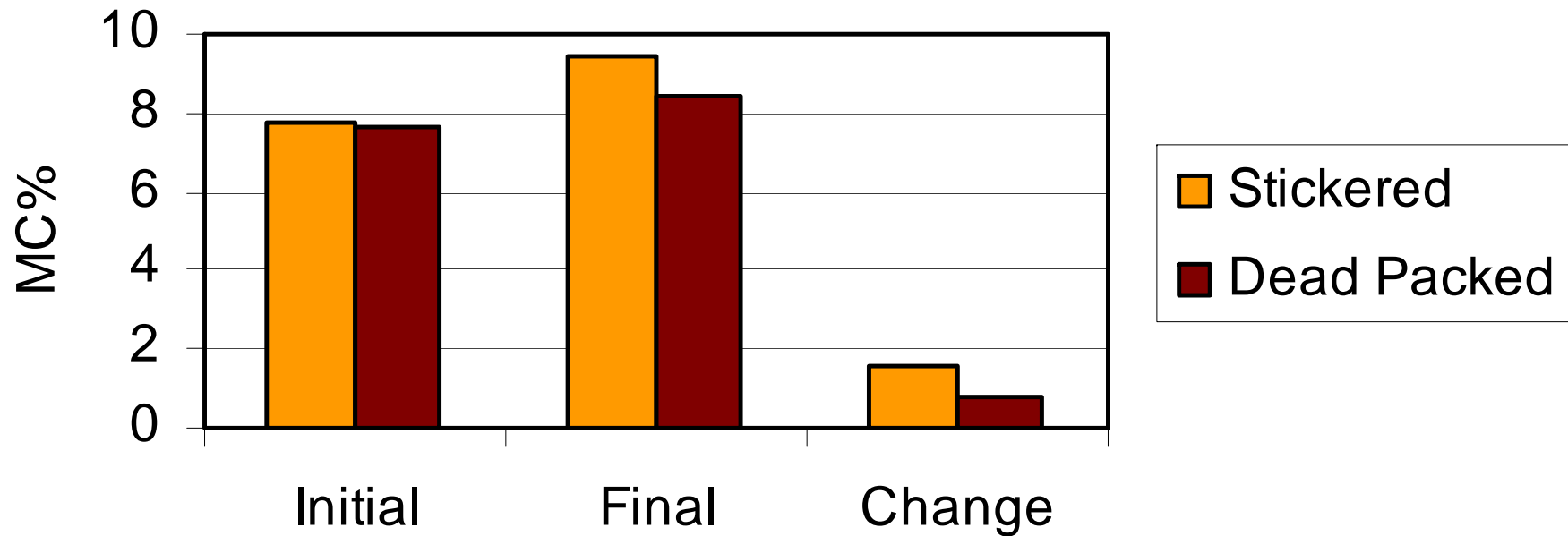
MC of Dead Packed Lumber



Dead Packed Lumber MC Gain





Avg. MCs & MC Change





Trial Summary

STICK

-  Average of 46 days gained 1.6% total
-  Gain of .034% per day

DEAD PACKED

-  Average of 72 days gained 0.8% total
-  Gain of .011% per day

Seasonal Effect



A similar winter storage trial showed moisture gains equal to or greater than those seen during summer storage

The Bottom Line

To ensure that no lumber would exceed 10% MC, an SOP limiting stickered lumber storage to 2 months and dead packed storage to 6 months was instituted

The Next Question



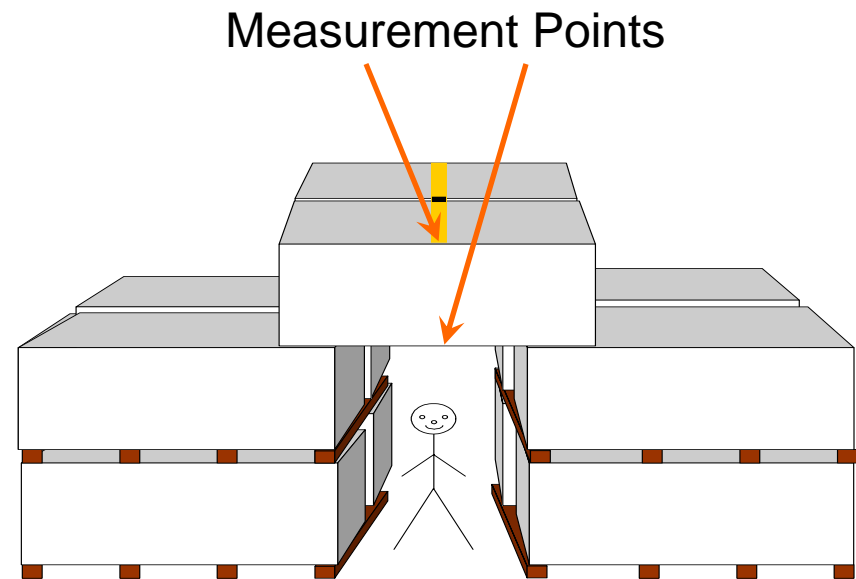
Could safe storage times be extended through the use of lumber packaging?

The Next Study

- ❖ Cover half of 42 pairs of dead packed lumber with sewn lumber envelopes made of woven 8X8 polypropylene
- ❖ All lumber initially between 6 – 8% MC
- ❖ The bottoms of half of the covered packs were covered with flat sheets of the same material to completely encapsulate the dry lumber
- ❖ One pack with and one without a bottom were paired with two uncovered control packs
- ❖ 40 pairs of packs (covered & controls) were scattered throughout a dry storage shed and left for 90 days during the winter of 2004
- ❖ The two remaining covered packs, one with a bottom and one without, were placed outside in the weather

Test Procedure

- ✿ The initial MCs of all boards on the top and bottom of the test packs were measured, at their middles, with a Wagner 612
- ✿ The same meter was used at the completion of the test to measure MCs in the same locations



**Technique for safely measuring
MCs of bottom boards**

The Study Site



The Outside Packs

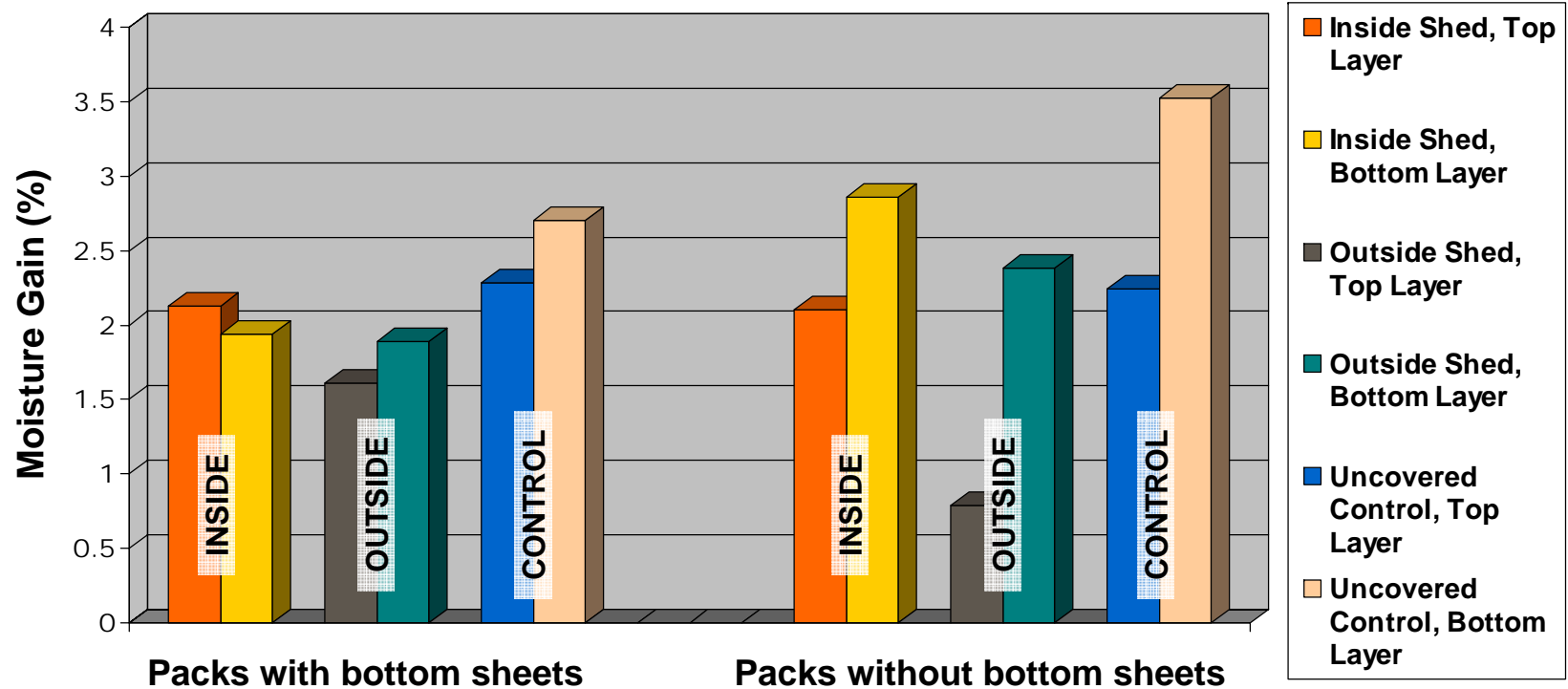


Climatological Data Collection

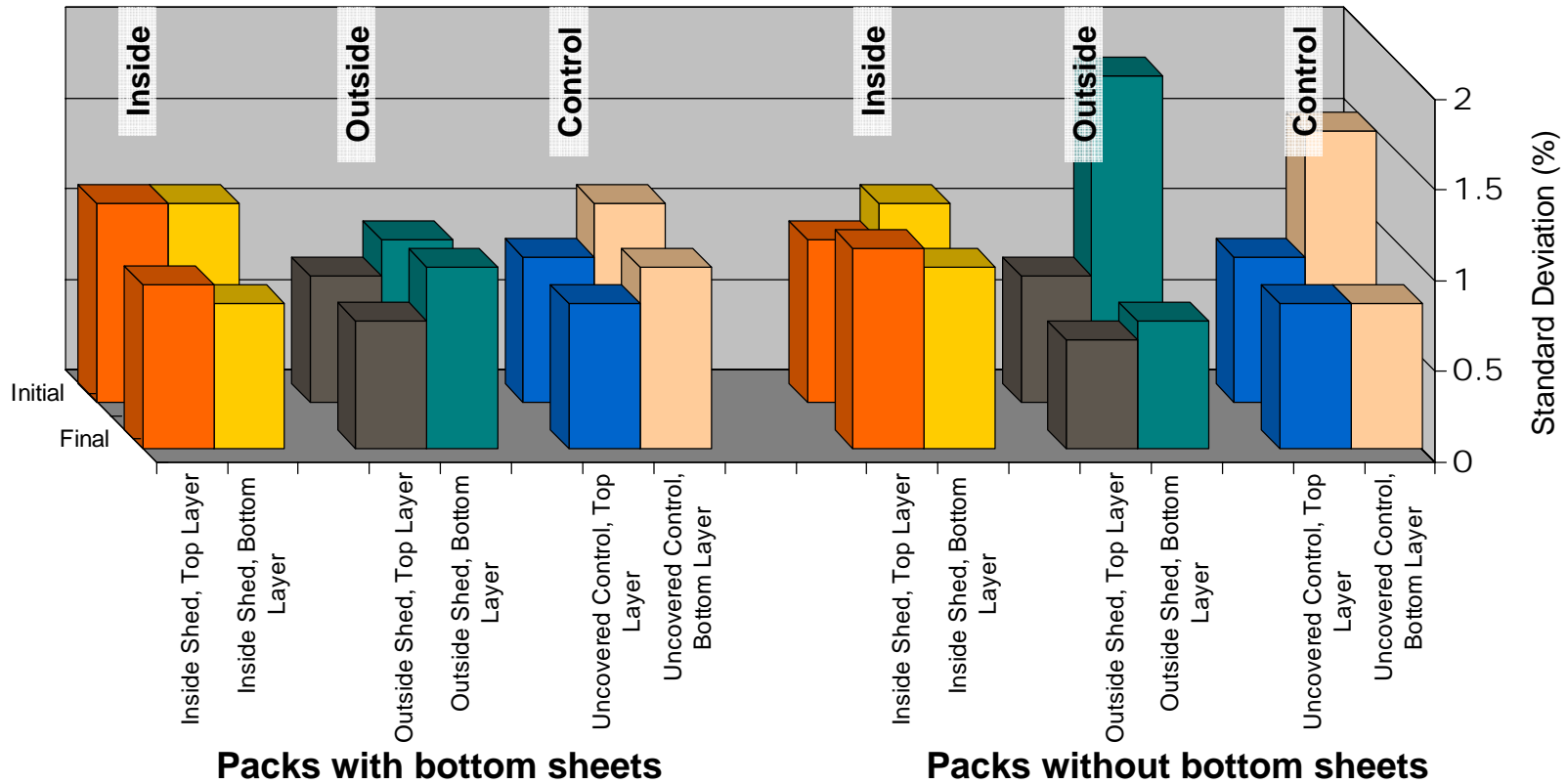


- ❖ Data loggers were placed with half of the control packs and half of the covered packs

Change in Moisture Content



Variability in Moisture Content



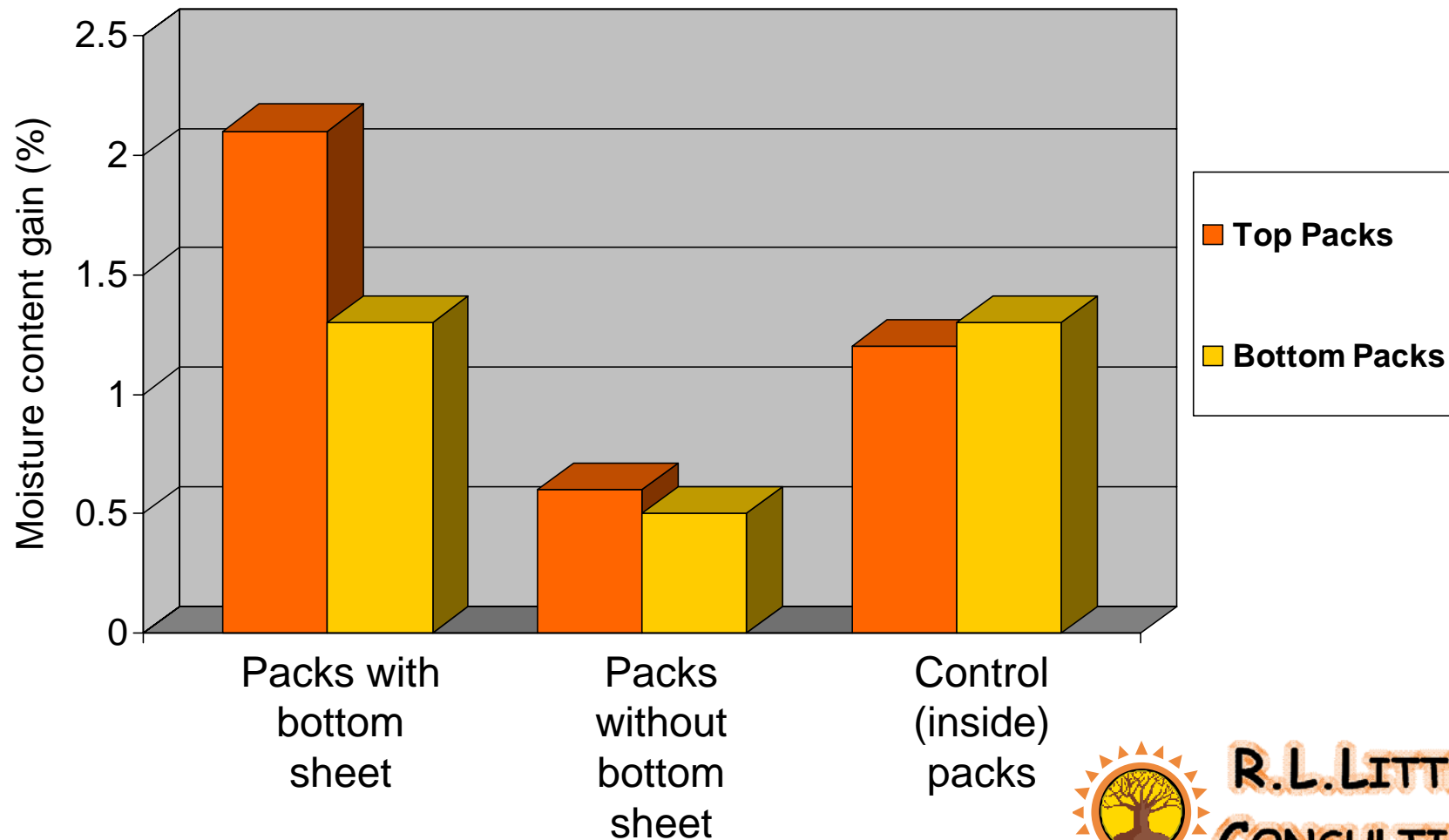
Conclusions

- ❖ The bottom layer in a pack tends to gain MC more quickly than does the top layer – regardless of whether covered or where stored
- ❖ Lumber can be successfully stored outside for at least 90 days when covered
- ❖ Lumber covers are of little benefit in retarding MC change of lumber in dry storage
- ❖ When covered lumber is stored outside a bottom sheet is needed only to protect the bottom layer in the bottom pack
- ❖ MC variability was less for all conditions at the conclusion of the test

The Final Study

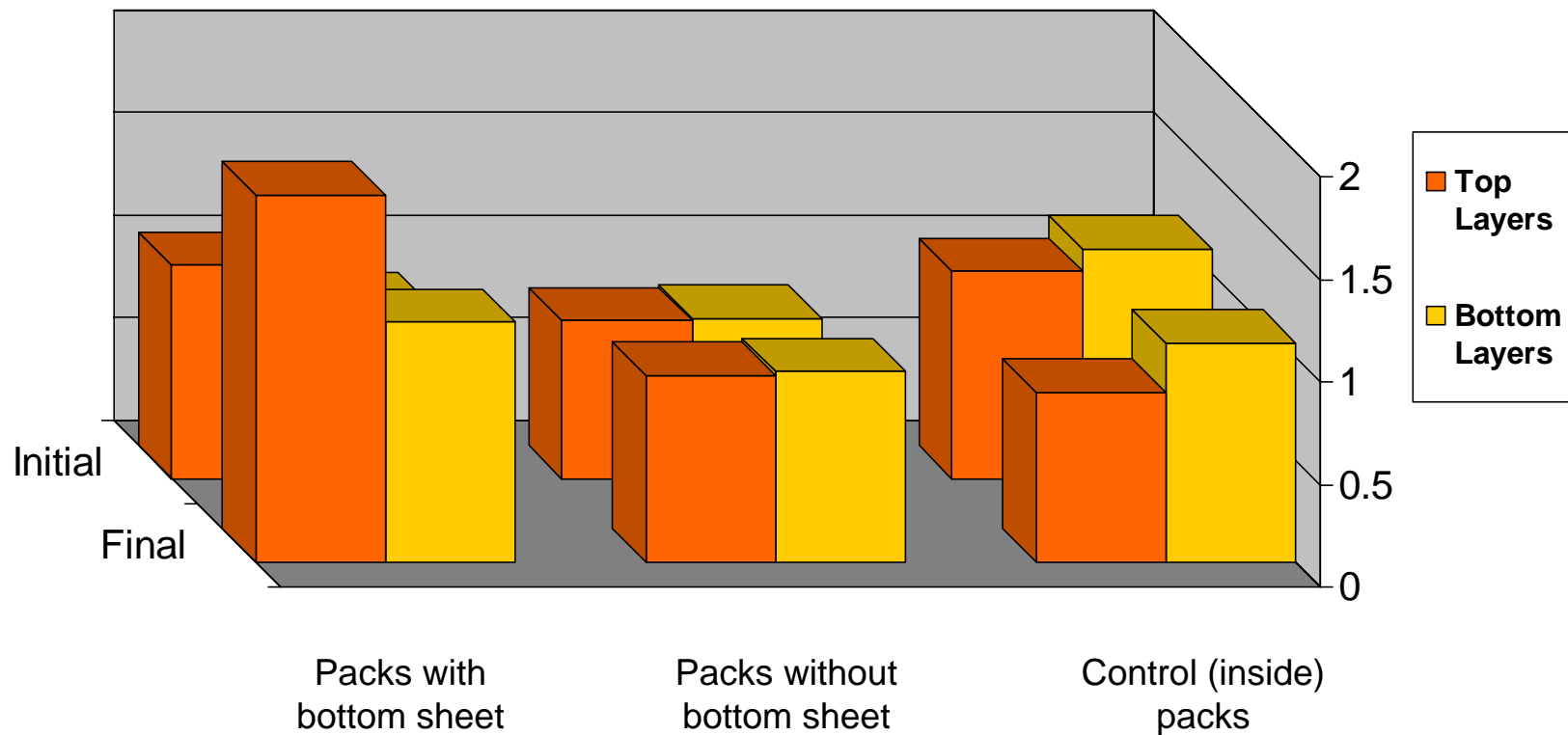
- ❖ Lumber covers used in the previous study were shipped to two other facilities
- ❖ All lumber initially between 6 – 8% MC
- ❖ At each facility each pack in a stack of 4 packs of dry lumber was covered
- ❖ Bottom sheets were used under half of the covered packs
- ❖ Lumber was left from November to March
- ❖ MC change of the covered packs was compared to the change in control packs inside dry storage

Change in Moisture Content



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CONSULTING**

Variability in Moisture Content



Conclusions

- ❖ Lumber covers provide an excellent option to store dry lumber outside for at least 90 days when dry storage is full
- ❖ Lumber under covers should be exposed to regular sunlight to retard the formation of condensation
- ❖ Bottom sheets seem to cause increased condensation thereby wetting top layers more than bottom
- ❖ The use of bottom sheets leads to an increase in the variability of final MCs
- ❖ Holes in the cover, even small ones, will lead to wet lumber in the vicinity of the hole