# Seasonal Effects on Moisture Loss of Loblolly Pine

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# Field Drying Literature Review

McMinn and Taras, 1982 – Drying of 6-inch Eucalyptus in Florida over a 4 week period starting in November.
Drying of 5 to 9-inch pine over a 2 week period during January and August.

McMinn, 1986 – Drying of red oak, sweetgum, and yellow-poplar 5 to 12 inches for 4 to 8 weeks starting in July.

# Field Drying Literature Review

Rogers, 1981 – Drying of loblolly pine, white oak, and sweetgum over a 3 month period in Texas starting in November. Separated heartwood and sapwood MC.

Garrett, 1985 – Drying of hard hardwoods, soft hardwoods, and softwoods in Vermont for 2 weeks. Two replications in July, one in August and one in September.

# Field Drying Literature Review

Patterson and Post, 1980 - Northern red oak and white birch 8 to 14 inches for 4 weeks during May for oak and July for birch.

Stokes, Watson and Miller, 1987 – Drying of loblolly pine, soft hardwoods, and hard hardwoods during late June thru mid-August in south Alabama. Second study done from August thru October.

# Outline

- Objectives
- Methods
- Results
- Heat Content
- Conclusions

# Objectives

1) Compare drying of delimbed and undelimbed stems with consideration to total moisture, foliage moisture, and stemwood moisture.

2) Compare seasonal drying rates through an entire year.

# Outcomes

- Initial results of field drying tests
- Model of field drying rates for loblolly pine that can be used to optimize harvesting and utilization processes

# Methods

Summer drying

10 trees (5 whole-tree and 5 delimbed)

Weighed weekly

April 2007 – September 2007

Fall and Winter drying

5 whole-trees for each season

Weighed daily during the week

October 2007 – January 2008 (Fall)

January 2008 – March 2008 (Winter)

# Methods

Summer drying

Trees were weighed with a tractor and hanging scale.

Fall and Winter drying

Trees were suspended from A-frames with hanging scales attached.

# Methods

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# Methods

## Fall and Winter drying

Trees were suspended from A-frames with hanging scales attached.

# Methods

<u>WatchDog Model 900 ET weather station</u>

Temperature

Rainfall

Relative humidity

Wind speed, gust, direction

Solar radiation

Dew point

Recorded in 30 minute intervals

# Methods

## Moisture Content

$$\text{Wet basis (\%)} = \frac{\text{wt. of water}}{\text{Wt. of wood + water}} \times 100$$

# Methods

## Moisture Content

Dbh

Mid

Top

Oven-dried at 105°C until constant weight obtained

# Results

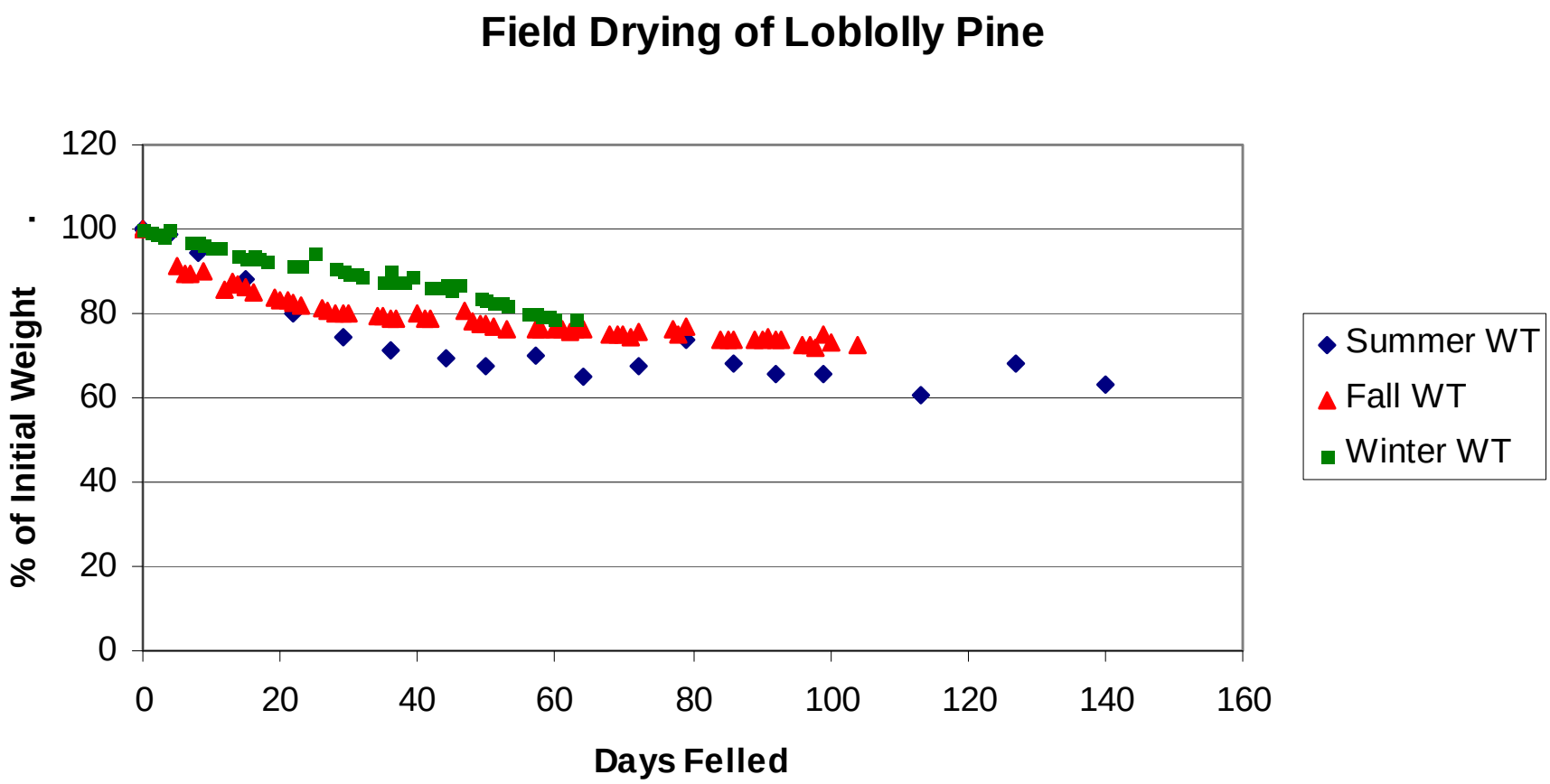
# Tree Size Summary

| Variable | Summer | | Fall | | Winter | |
|---|---|---|---|---|---|---|
| | N | Mean | N | Mean | N | Mean |
| Dbh (in) | 10 | 5.7 | 5 | 5.6 | 5 | 5.3 |
| Total Height (ft) | 10 | 45.2 | 5 | 47.0 | 5 | 50.3 |
| Weight (lb) | 10 | 276.5 | 5 | 265.8 | 5 | 264.4 |

# Climatological Data

| Season | Temp. (F) | RH (%) | Rainfall (in) | Wind Gust (mph) |
|---|---|---|---|---|
| Summer | 78.0 | 94.1 | 6.13 | 17.8 |
| Fall | 53.6 | 69.9 | 14.71 | 10.1 |
| Winter | 51.0 | 57.9 | 10.27 | 12.8 |

# Drying Rates



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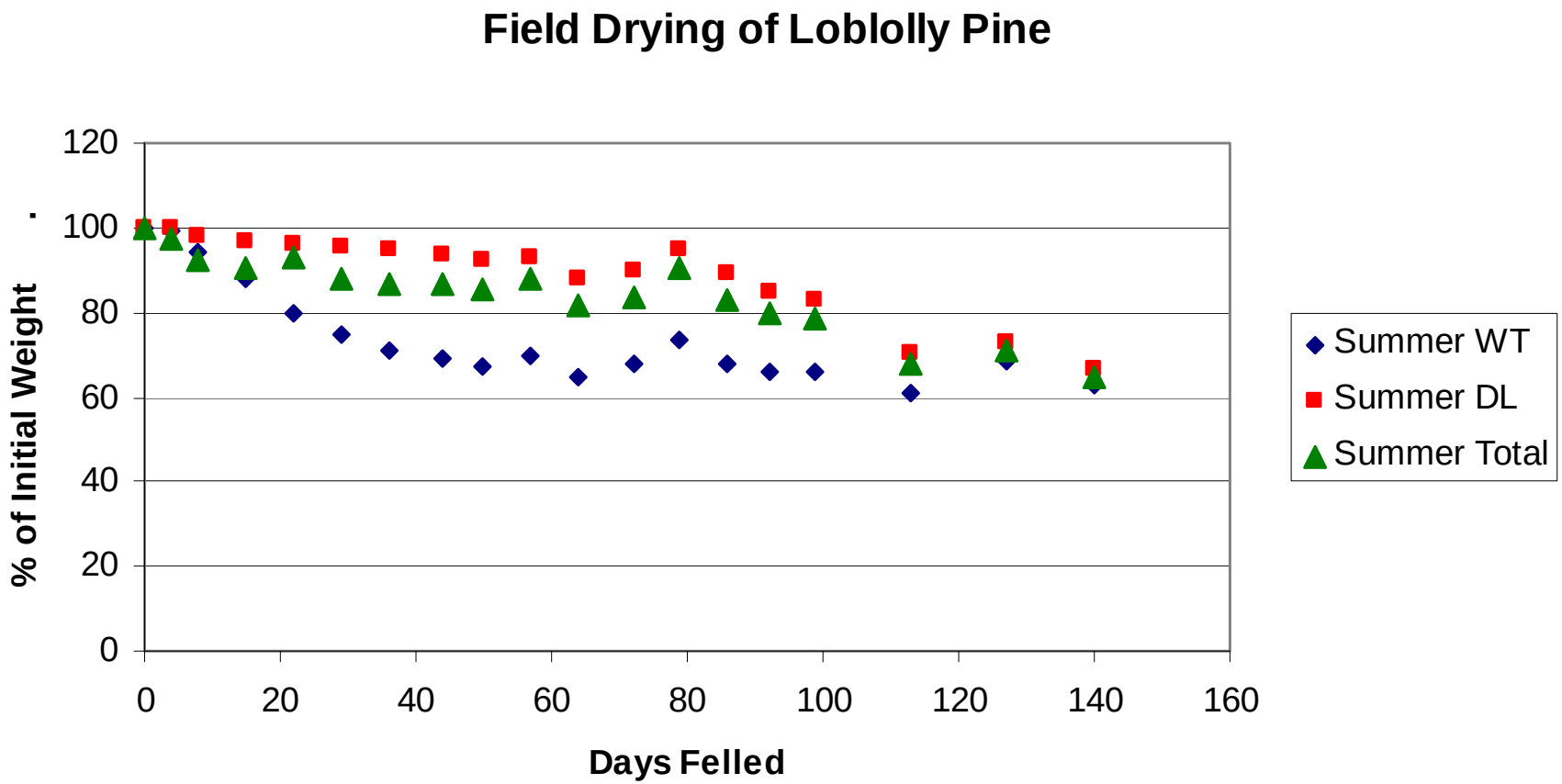

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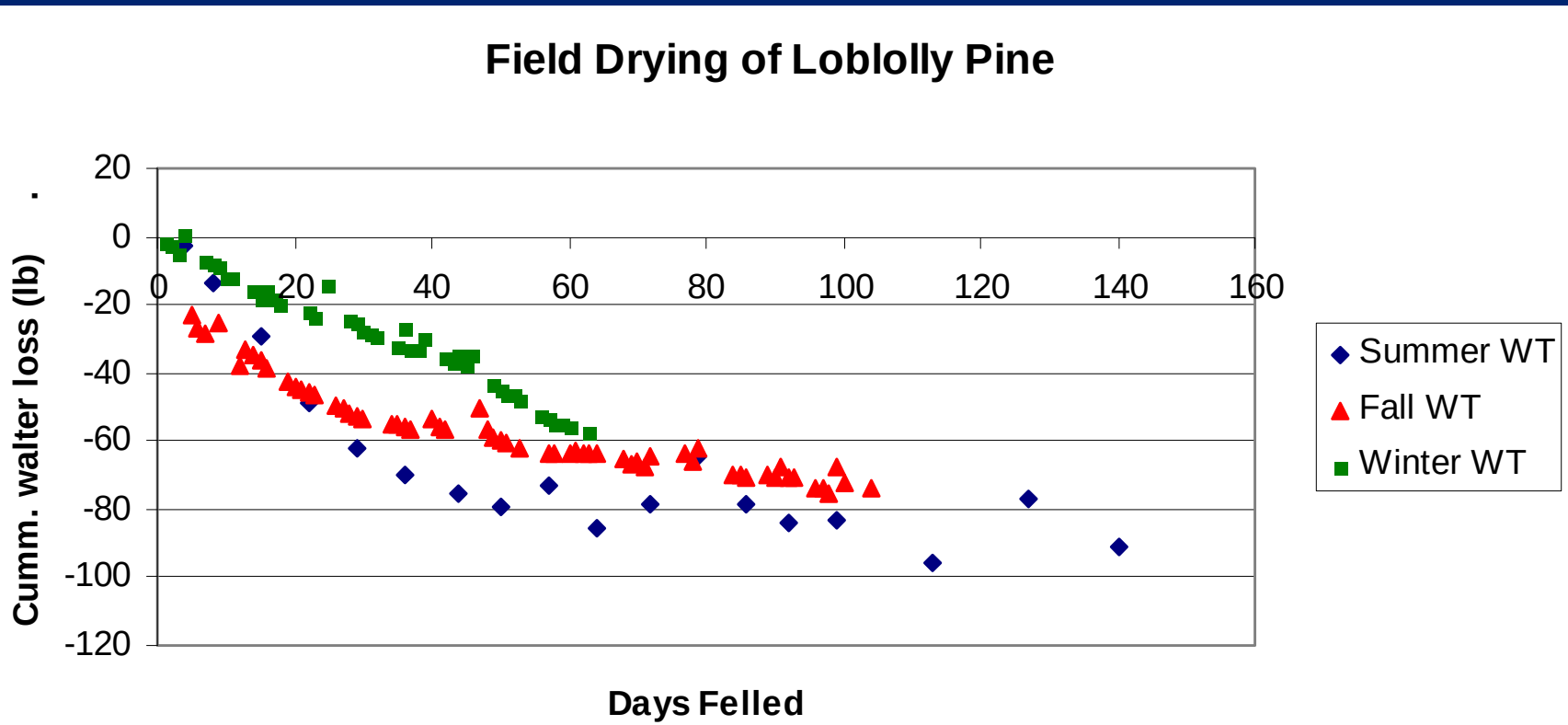

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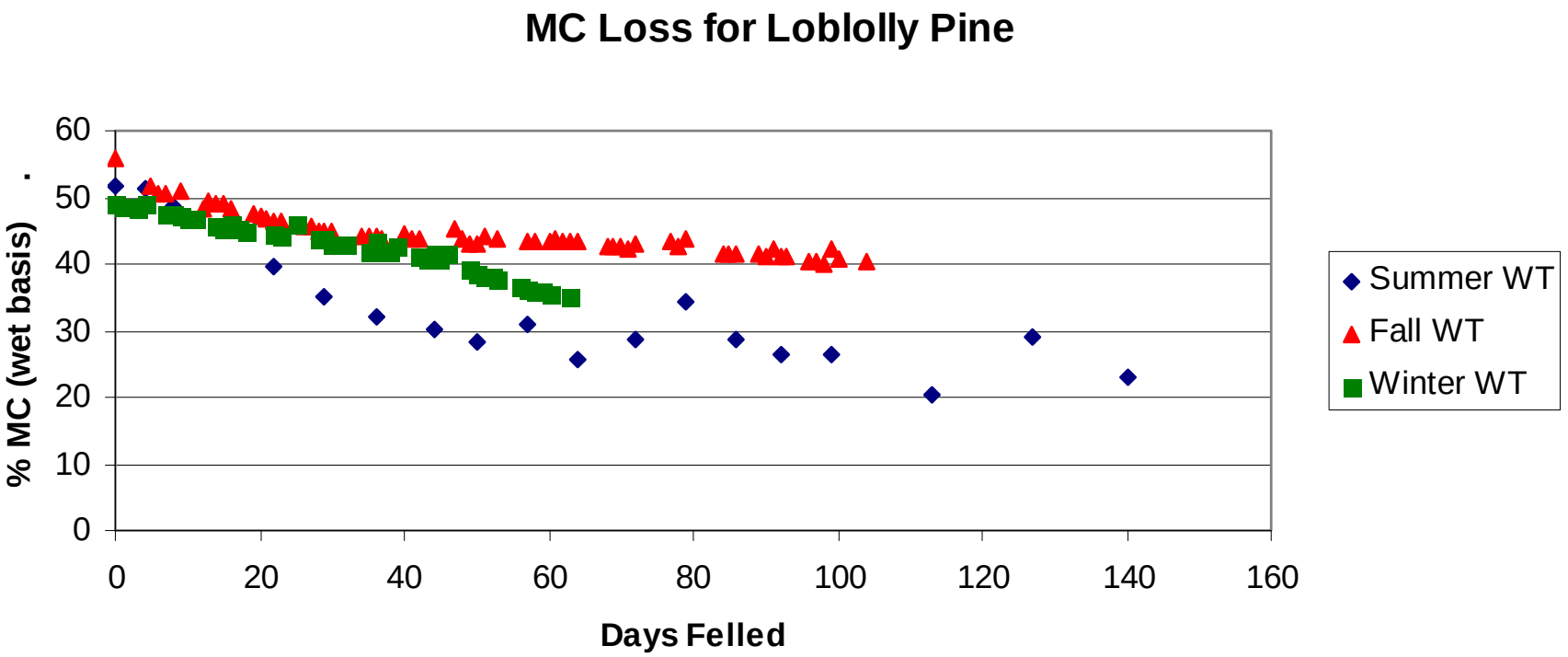


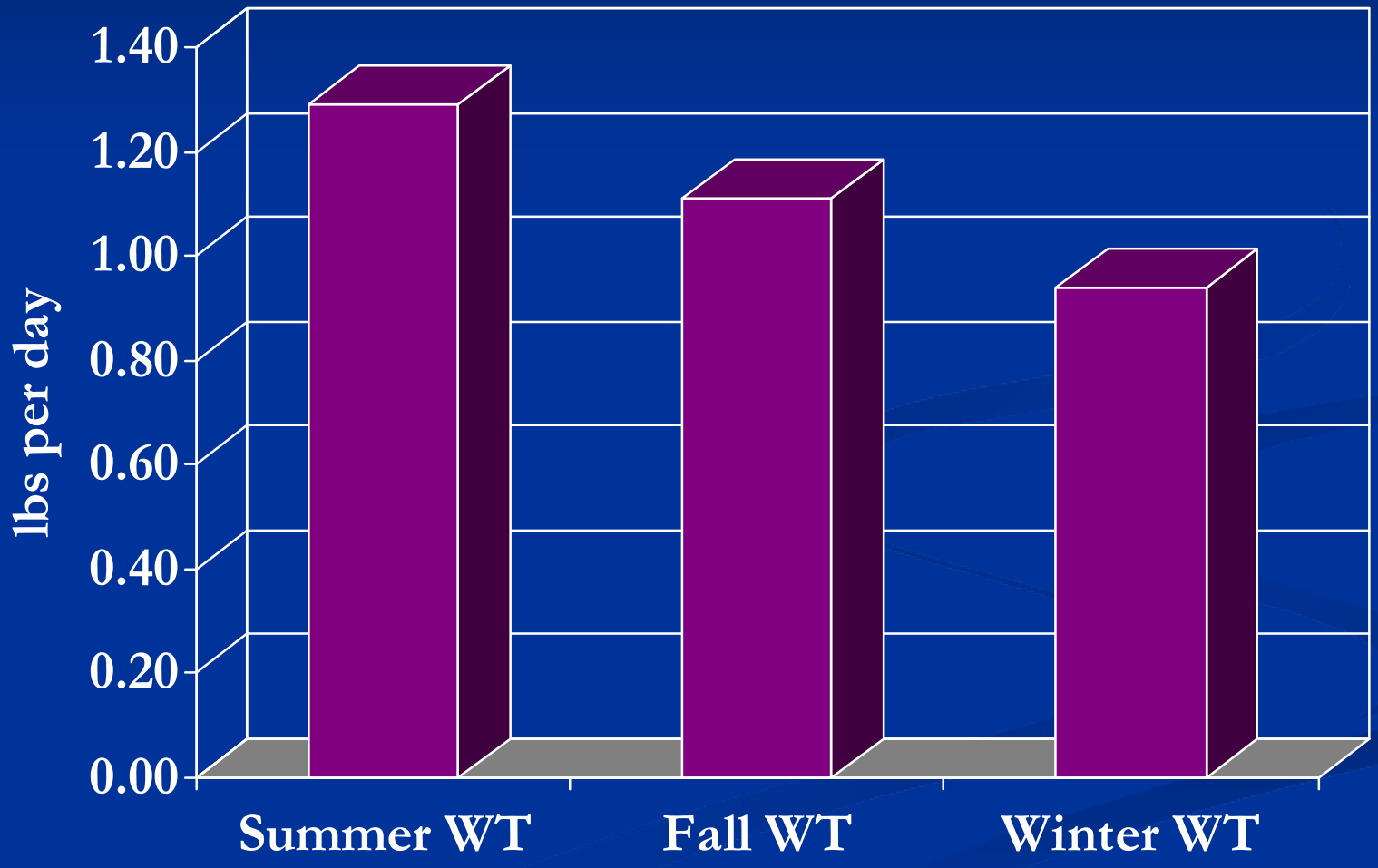
# Drying Rates

| Season | Days Felled | Weighing Interval (days) | Weight loss/day (lbs) | Final Weight (% of Initial) |
|---|---|---|---|---|
| Summer WT | 140 | 7.8 | 0.65 | 62.8 |
| Fall WT | 104 | 1.7 | 0.71 | 72.3 |
| Winter WT | 63 | 1.4 | 0.91 | 78.4 |

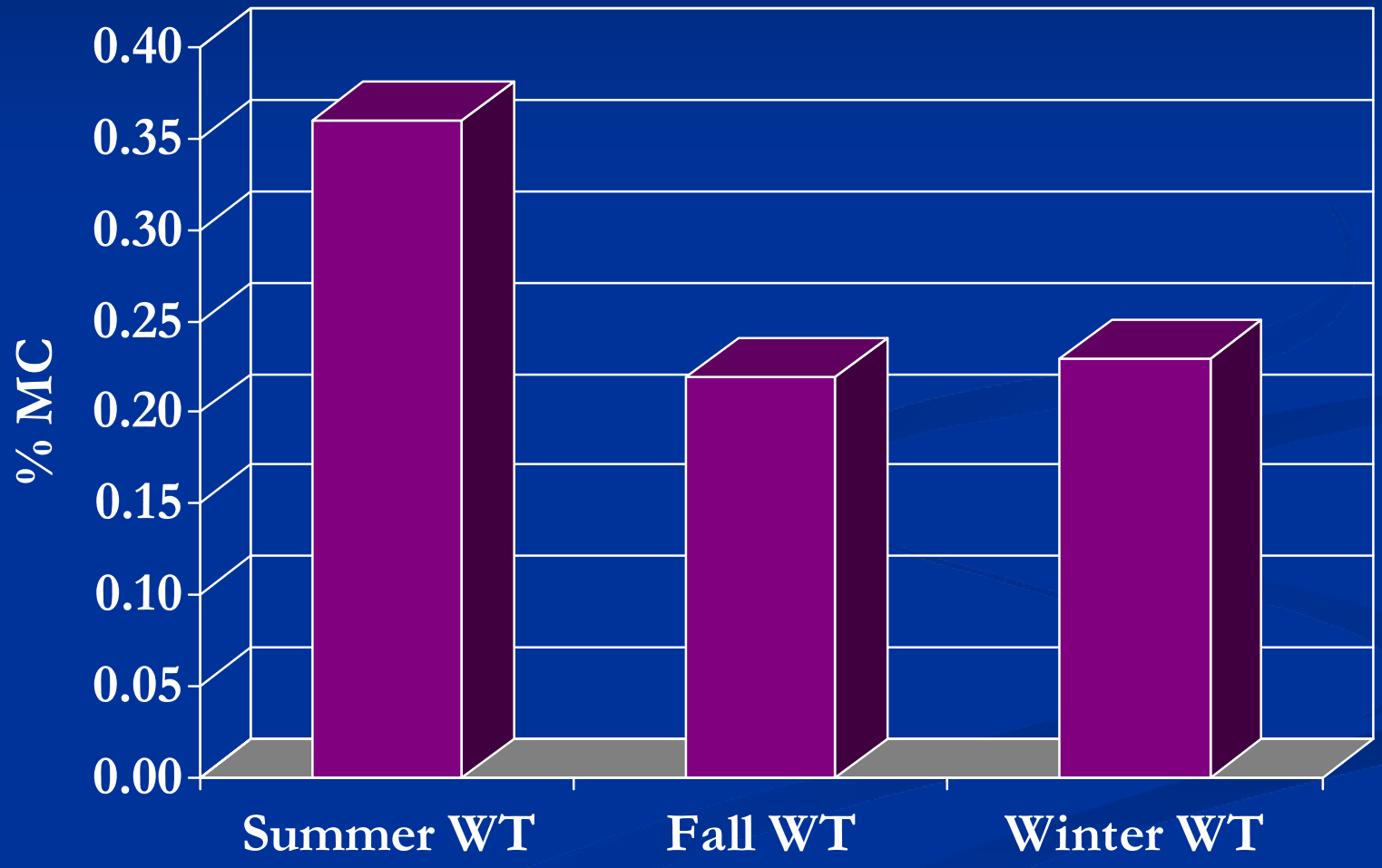
# Drying Rates

| Season | Days Felled | Initial MC (wet basis) | Final MC (wet basis) | % MC Reduction |
|---|---|---|---|---|
| Summer WT | 140 | 51.7 | 23.1 | 55.3 |
| Fall WT | 104 | 56.7 | 40.1 | 29.4 |
| Winter WT | 63 | 48.9 | 34.8 | 29.0 |

# Water Loss for First 57 Days



# MC Reduction Rate per Day for First 57 Days



# Heat Content

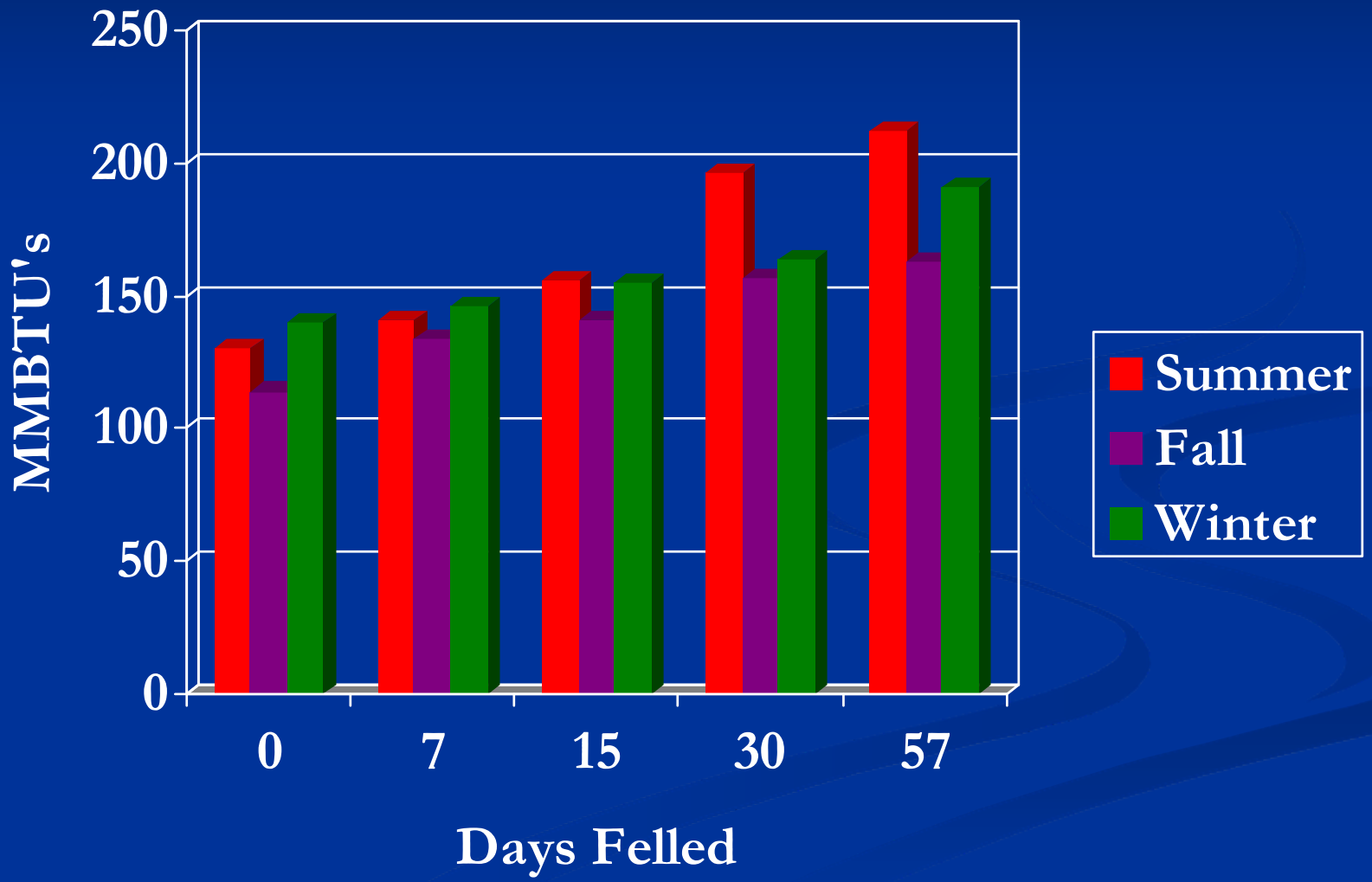
**Higher Heat Value (HHV)**

**Total amount of heat obtainable from oven dry material, allowing no deductions for heat losses (Koch, 1972).**

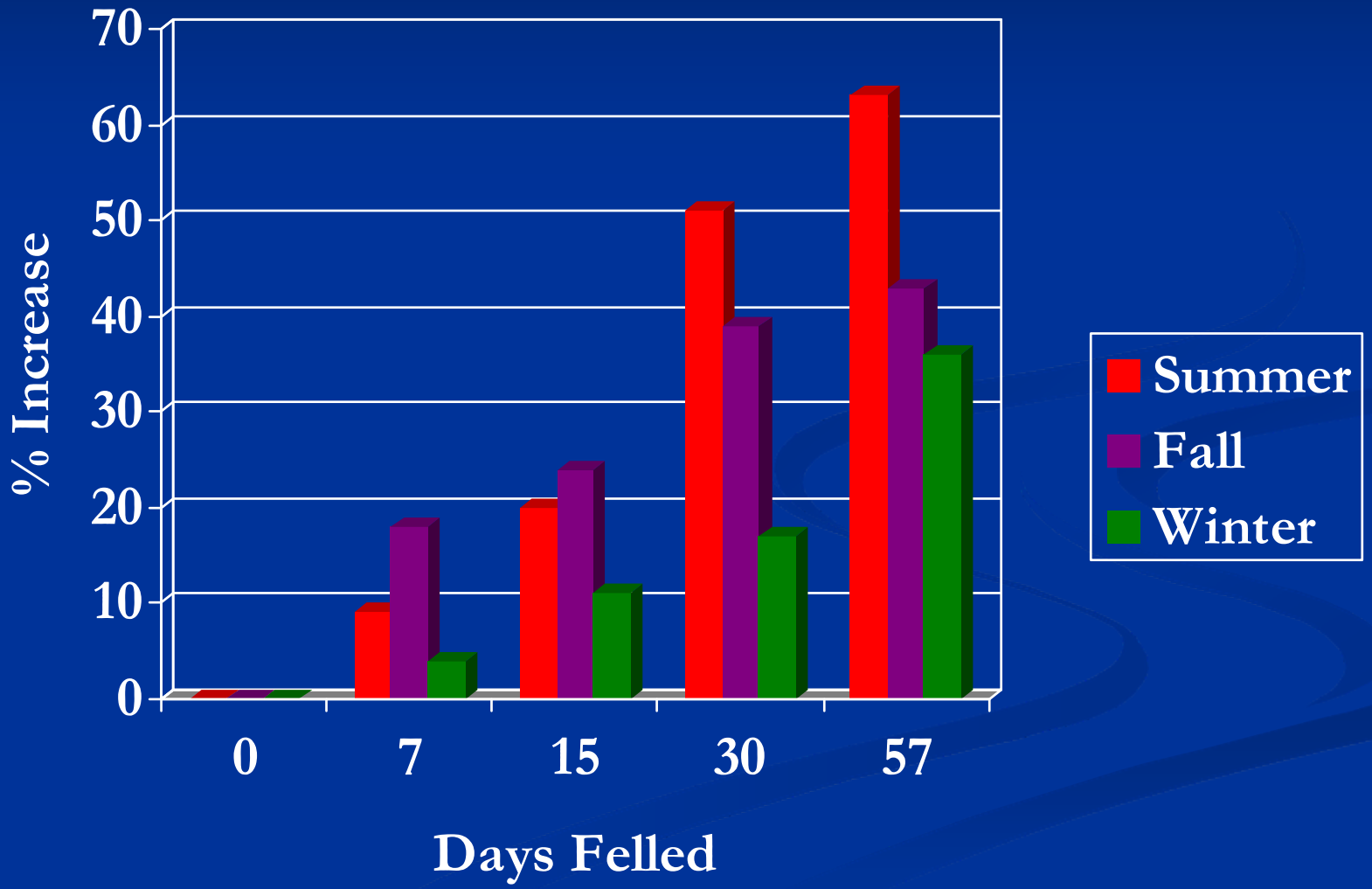
**Net Heat Value (NHV)**

**Available heat content of a substance after accounting for losses due to moisture, hydrogen, dry gas and excess air, and conventional heat loss (Ince, 1979).**

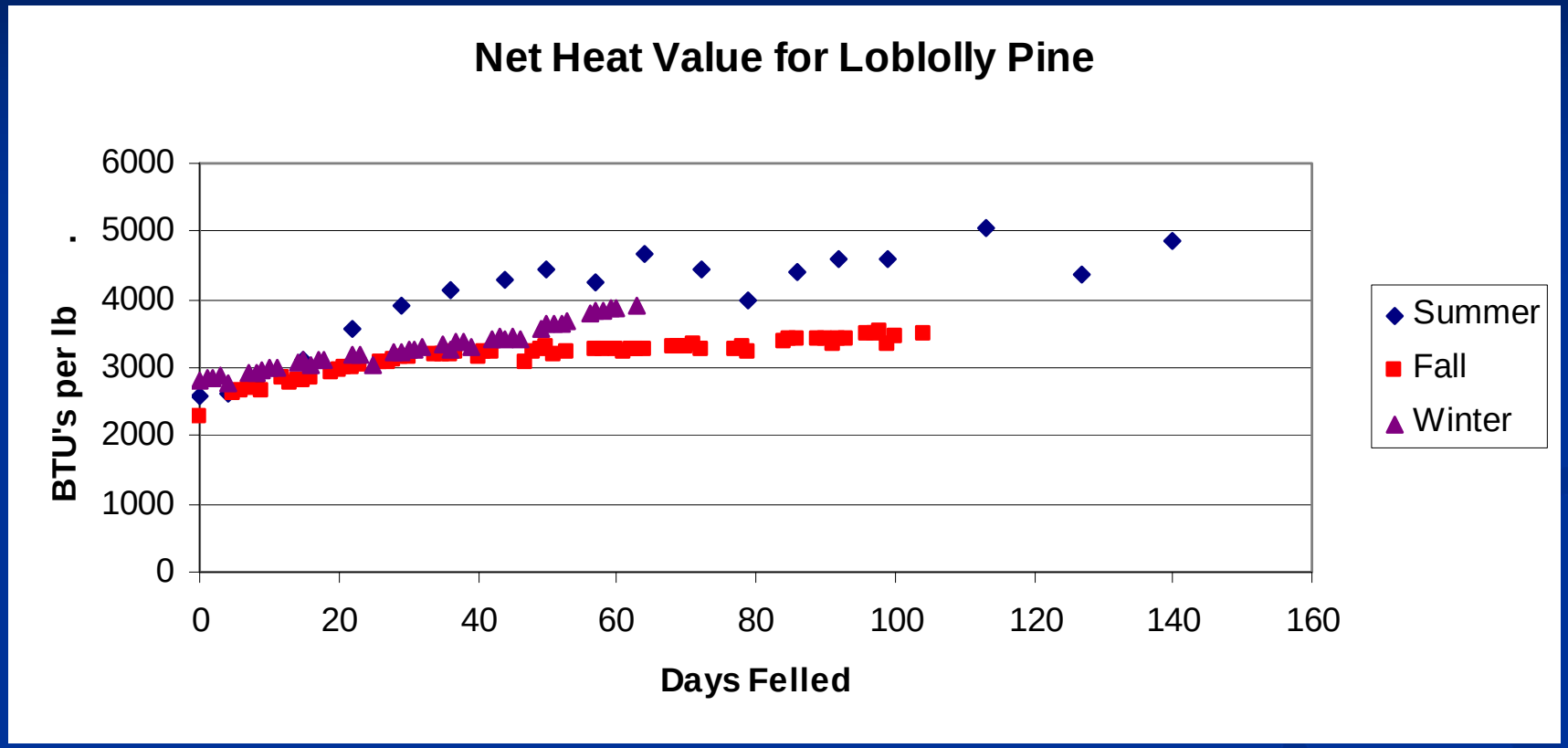
# MMBTU Content for 25-ton Load



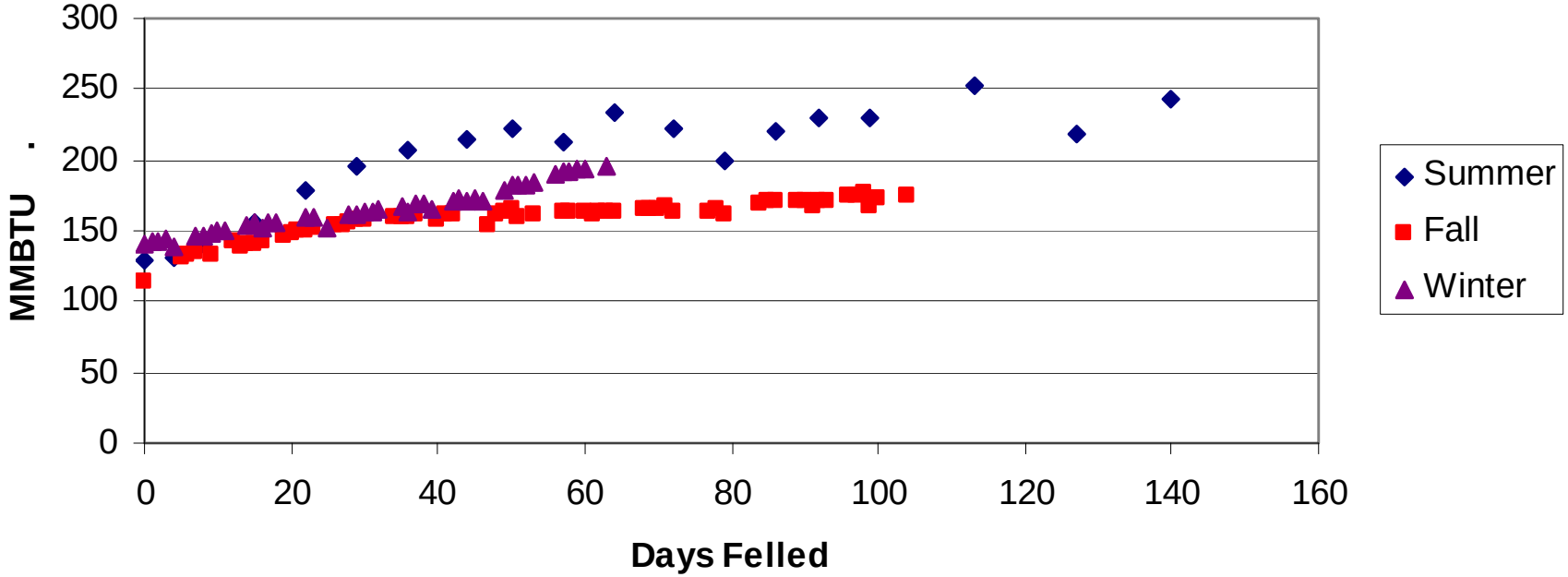
# Increase in MMBTU's for 25-ton Load



# Increase in BTU's



# MMBTU's for Load



# Conclusions

- The rate of moisture content loss during the first 57 days of drying was highest for the summer period.
- Field drying resulted in substantial gains in recoverable heat energy for summer, fall, and winter seasons.
- Substantial gains in MMBTU content were realized after only 30 days of field drying for each season.

# Conclusions

- There was some overlap between seasons (summer drying included some spring season and fall drying ended in January).

- Further statistical analysis will be done to address the effect of different drying times and climate conditions.

# THANK YOU!