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Project Report No. 40, Influence of Plantation Variables on Crown Height

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Influence of Plantation Variables on Crown Height

by

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Report 40

From
the

East Texas Pine Plantation Research Project
College of Forestry
SFASU
Nacogdoches, TX 75962

January ... 1996

A plantation management question...

Is it possible to estimate the distance from the ground to the first live branch of a planted pine tree?

The East Texas Pine Plantation Research Project (ETPPRP) in a recent investigation addressed this question, and the answer was yes. An analysis of the ETPPRP data set produced equations to estimate crown height (the distance from the ground to the first live branch). Two of the equations are:

Unthinned Loblolly Pine Plantations in East Texas

$$CH = EXP[-6.13694+2.17634\ln(H)+0.09754\ln(T)-0.00462R+0.003551N]$$

R^2 = 92.8% and RMSE = 0.25

Unthinned Slash Pine Plantations in East Texas

$$CH = EXP[-4.82006+2.05610\ln(H)+0.00327\ln(T)-0.00731R+0.00253N]$$

R^2 = 92.7% and RMSE = 0.25

Where:
- CH = Average distance from ground to first live branch (stand-level basis) - ft.
- H = Average total height of the 10 tallest trees - ft.
- T = Number of planted trees per acre.
- R = Percentage of planted trees with fusiform rust galls on stems.
- N = Non-planted vegetation basal area per acre - sqft.

A paper that formally presents these equations plus additional equations and several possible applications has been submitted to the Southern Journal of Applied Forestry for consideration for publication. This report is an extension of that paper.

Another plantation management question...
What is the influence of H, T, R and NPVBA on CH?

The two equations presented on the previous page provided an opportunity to explore the influence of certain plantation parameters on the rising or lowering of stand-level crown height in unthinned loblolly and slash pine plantation in East Texas. In this report, 27 charts are presented that depict the changes in CH for several representative combinations of H, T, R and N. The value ranges were designed to coincide with the ETPPRP data sets from which the equations were derived.

Observed Ranges of Loblolly Pine Data Set

H => 8' to 77'	with avg = 40'
T => 87 to 998	with avg = 469
R => 0 to 50%	with avg = 9%
N => 0 to 86 sqft	with avg = 7 sqft

Observed Ranges of Slash Pine Data Set

H => 4' to 89'	with avg = 39'
T => 78 to 1032	with avg = 389
R => 0 to 94%	with avg = 40%
N => 0 to 160 sqft	with ovg = 13 sqft

The charts are organized three to a page. In a chart, each bar represents the distance from the ground to the first live branch. That is, each bar is the lower tree stem that is clear of live branches. One set of bars is for loblolly, and the other set is for slash.

At the top of each chart, the plantation parameters that are constant are defined, and the parameter on the horizontal chart axis varies across a range of values.

A Comment or Two on Interesting Influences

Influence of Trees per Acre (T) on Stand-level Crown Height (CH) => (Charts 1-9)

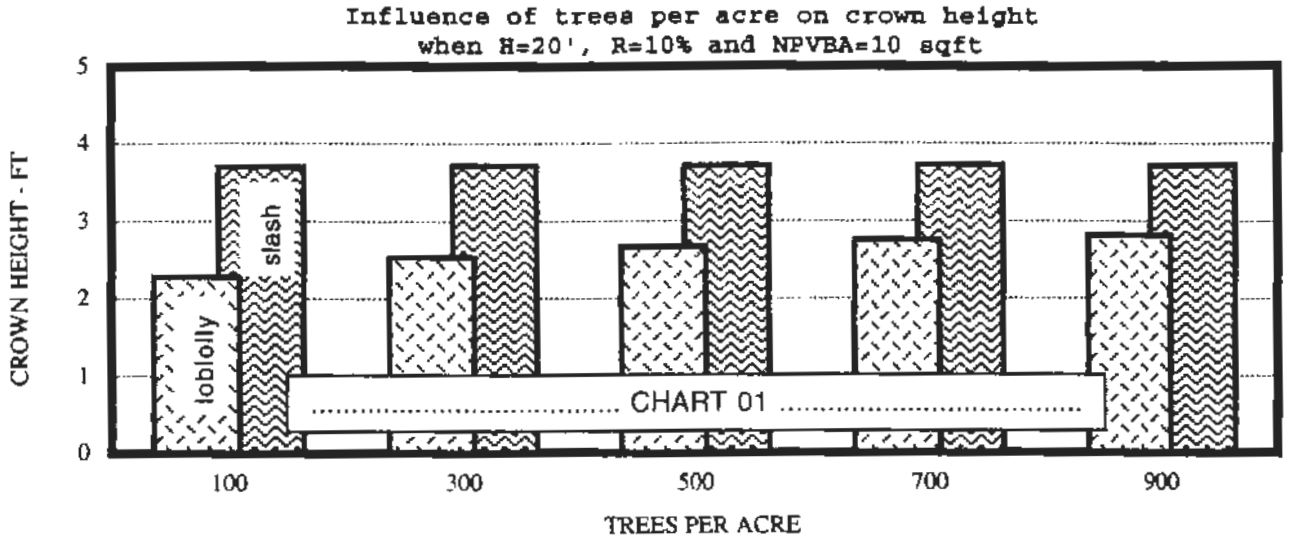
- Loblolly
  - Trees per acre does appear to affect CH. As T increases, CH increases.
  - In Chart 1, as T varies from 100 to 900, CH increases about 22%.
  - In Chart 6, as T varies from 100 to 900, CH increases about 24%.
- Slash
  - However, influence of planted trees per acre on CH is indiscernable in slash pine plantations. **This is very interesting.**

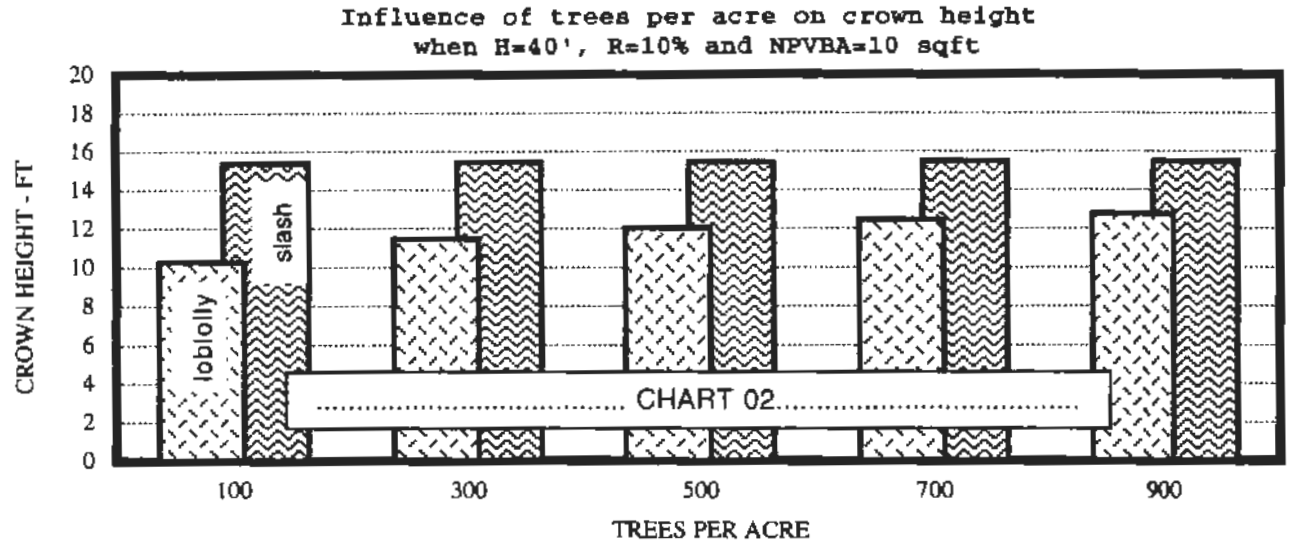
Influence of Fusiform Rust (R) on Stand-level crown height (CH) => (Charts 10-18)

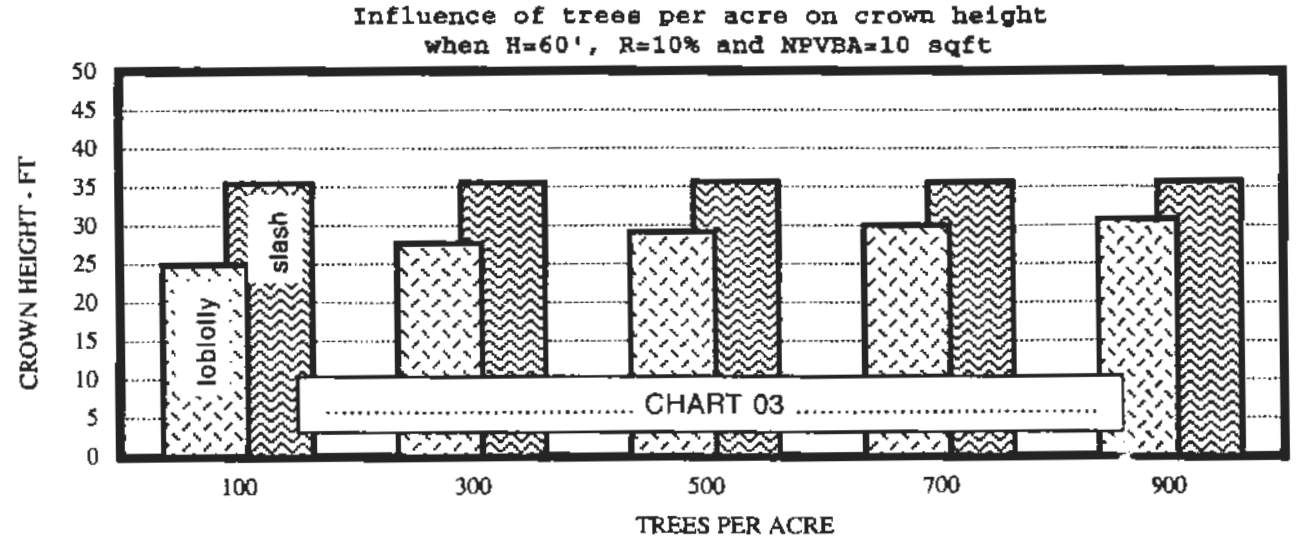
- Loblolly
  - Stem galls do appear to affect CH. As rust percentage increases, CH decreases.
  - In Chart 14, CH decreases 2' or 14%, as R increases.
- Slash
  - Stem galls do appear to affect CH. As rust percentage increases, CH decreases.
  - In Chart 14, CH decreases 4' or 24%, as R increases.
- Apparently loblolly and slash stems with fusiform rust galls tend to retain live branches longer than stems clear of galls. **This is very interesting.**

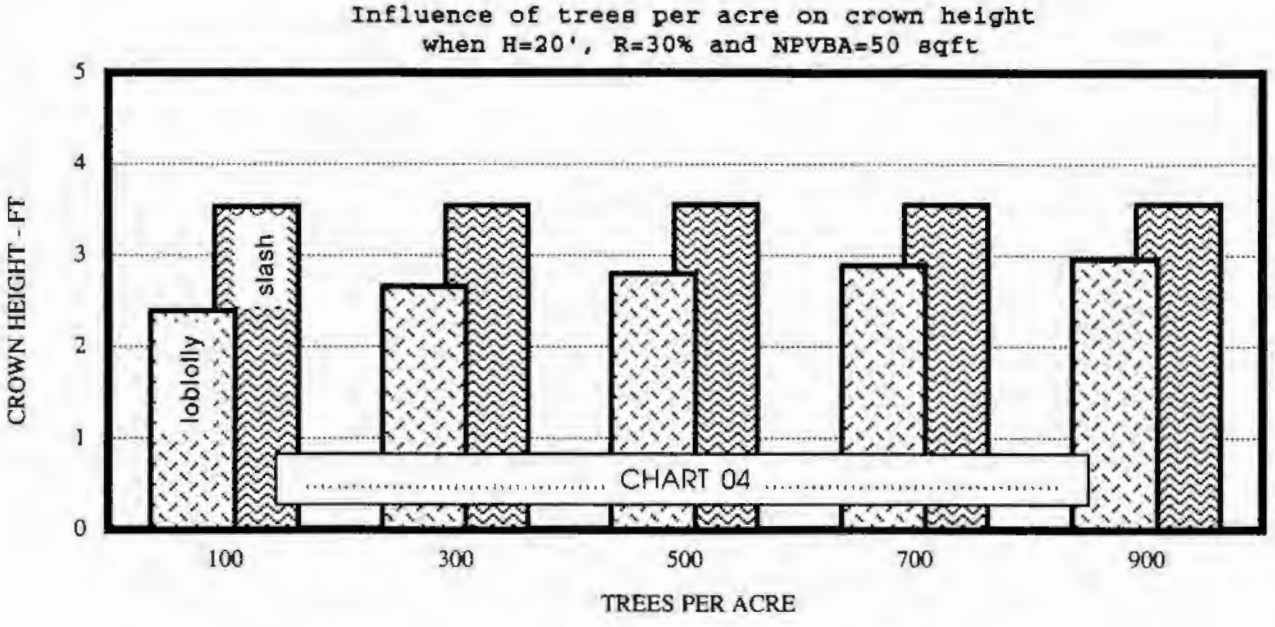
Influence of Non-planted Vegetation (N) on Stand-level crown height (CH) => (Charts 19-27)

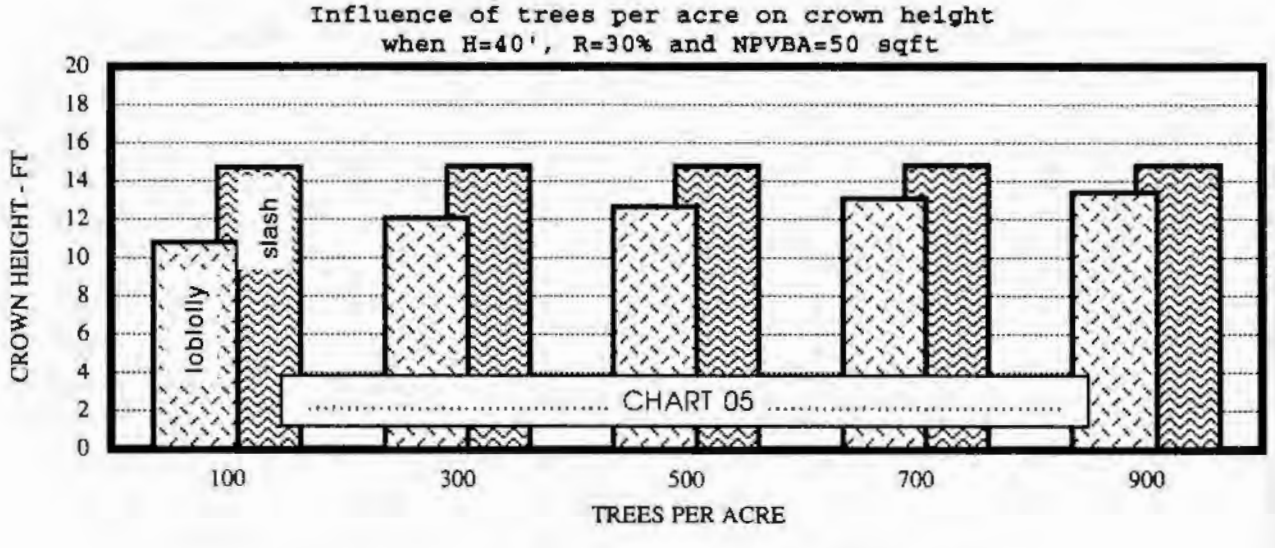
- Loblolly
  - As N increases, CH tends to increase.
  - In Chart 20, CH is expected to increase from about 12' to about 15', as N increases.
  - In Chart 27, CH is expected to increase from about 25' to about 33', as N increases.
- Slash
  - As N increases, CH tends to increase. However, recall from Charts 1-9 that as planted trees per acre increases, CH is not affected. **This is very interesting.**

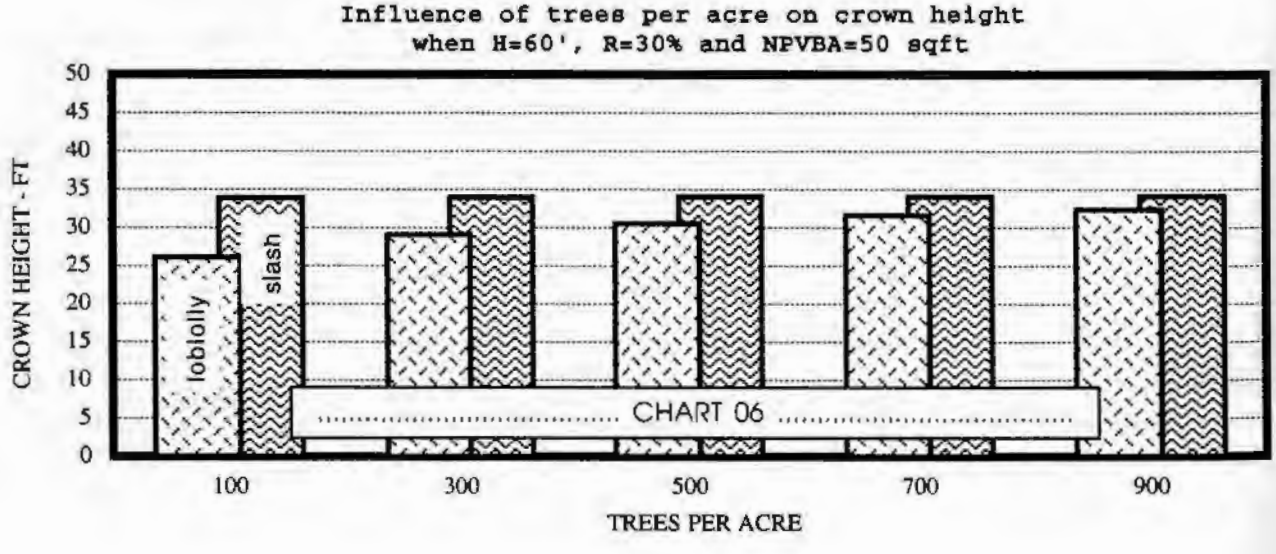

Influence of trees per acre on crown height
when H=20', R=10% and NPVBA=10 sqft
CROWN HEIGHT - FT
0
1
2
3
4
5
loblolly
slash
CHART 01
100
300
500
700
900
TREES PER ACRE


Influence of trees per acre on crown height
when H=40', R=10% and NPVBA=10 sqft
CROWN HEIGHT - FT
0
2
4
6
8
10
12
14
16
18
20
loblolly
slash
CHART 02
100
300
500
700
900
TREES PER ACRE

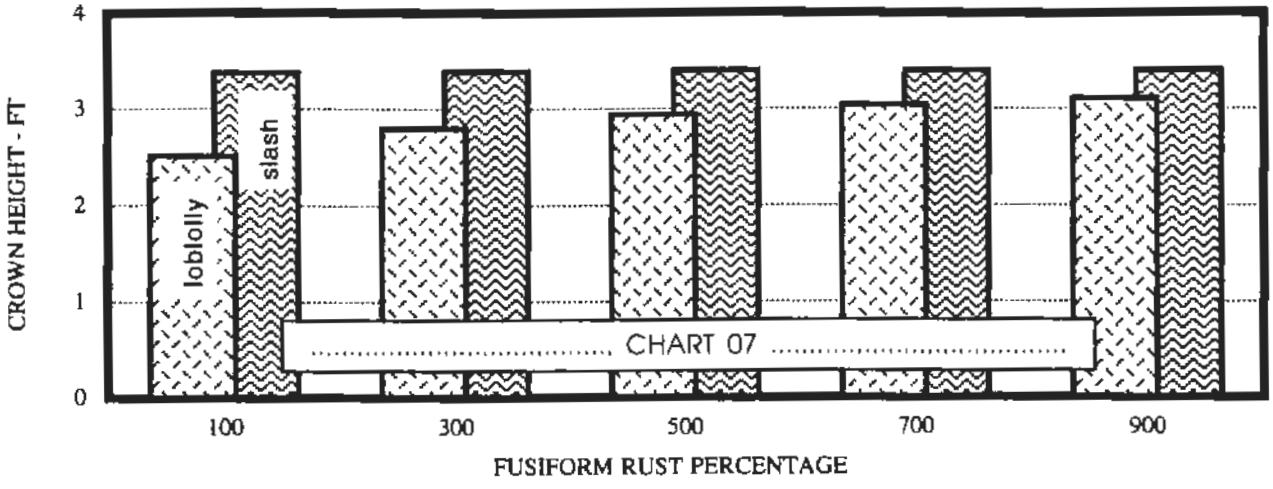

Influence of trees per acre on crown height
when H=60', R=10% and NPVBA=10 sqft
CROWN HEIGHT - FT
0
5
10
15
20
25
30
35
40
45
50
loblolly
slash
CHART 03
100
300
500
700
900
TREES PER ACRE


Influence of trees per acre on crown height
when H=20', R=30% and NPVBA=50 sqft
CROWN HEIGHT - FT
0
1
2
3
4
5
loblolly
slash
CHART 04
100
300
500
700
900
TREES PER ACRE

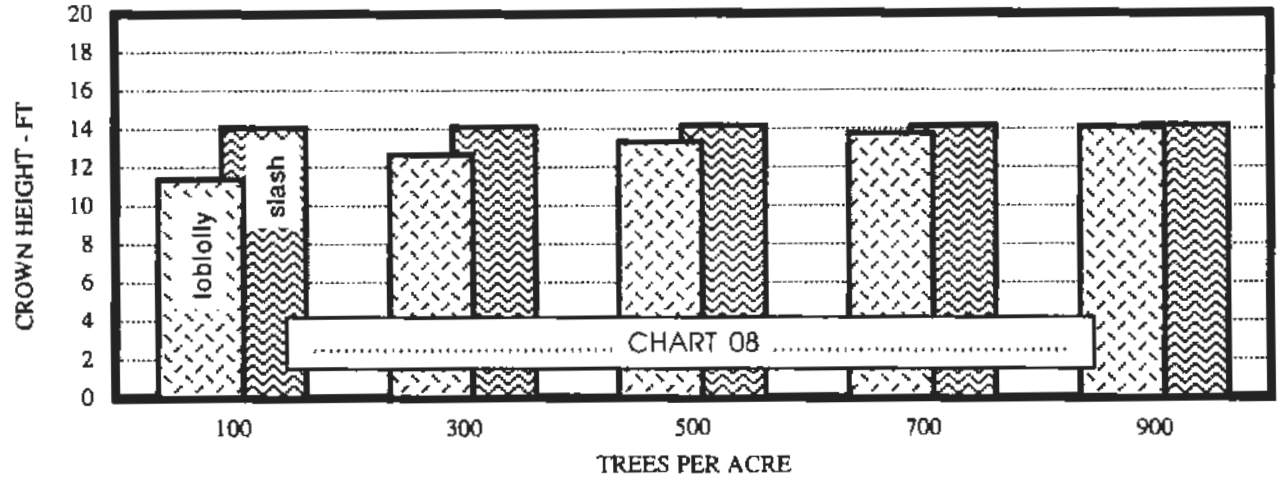

Influence of trees per acre on crown height
when H=40', R=30% and NPVBA=50 sqft
CROWN HEIGHT - FT
0
2
4
6
8
10
12
14
16
18
20
loblolly
slash
CHART 05
100
300
500
700
900
TREES PER ACRE


Influence of trees per acre on crown height
when H=60', R=30% and NPVBA=50 sqft
CROWN HEIGHT - FT
0
5
10
15
20
25
30
35
40
45
50
loblolly
slash
CHART 06
100
300
500
700
900
TREES PER ACRE

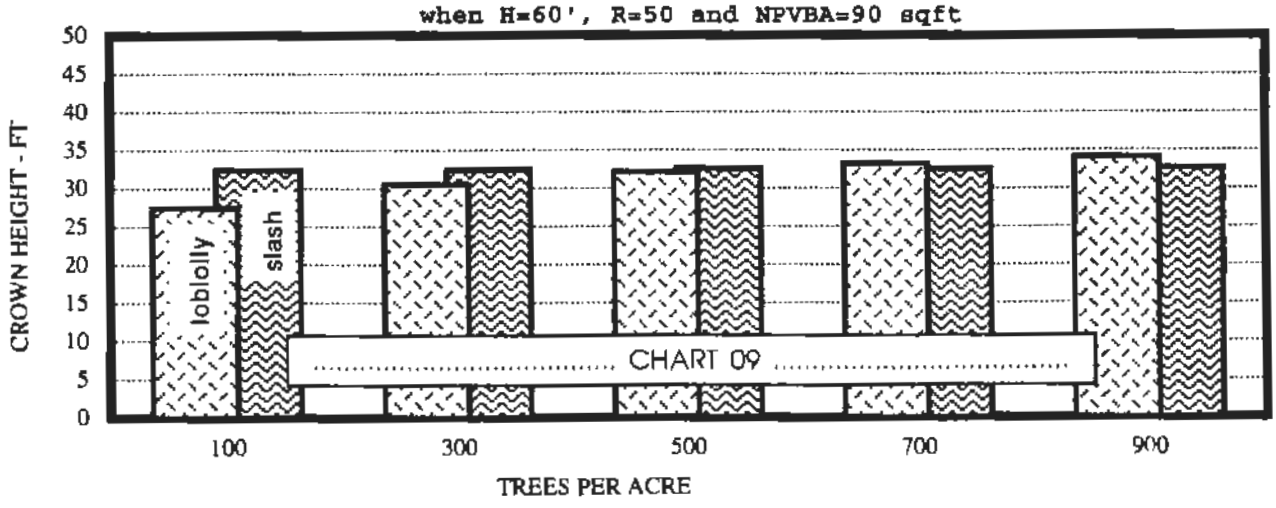
Influence of trees per acre on crown height
when H=20', R=50% and NPVBA=90 sqft

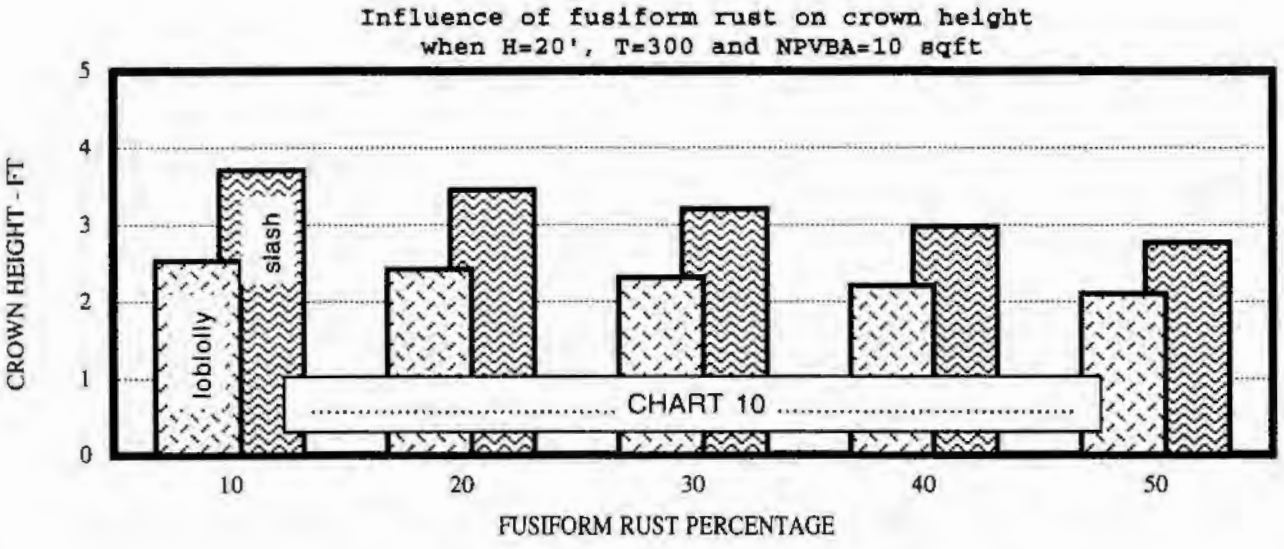


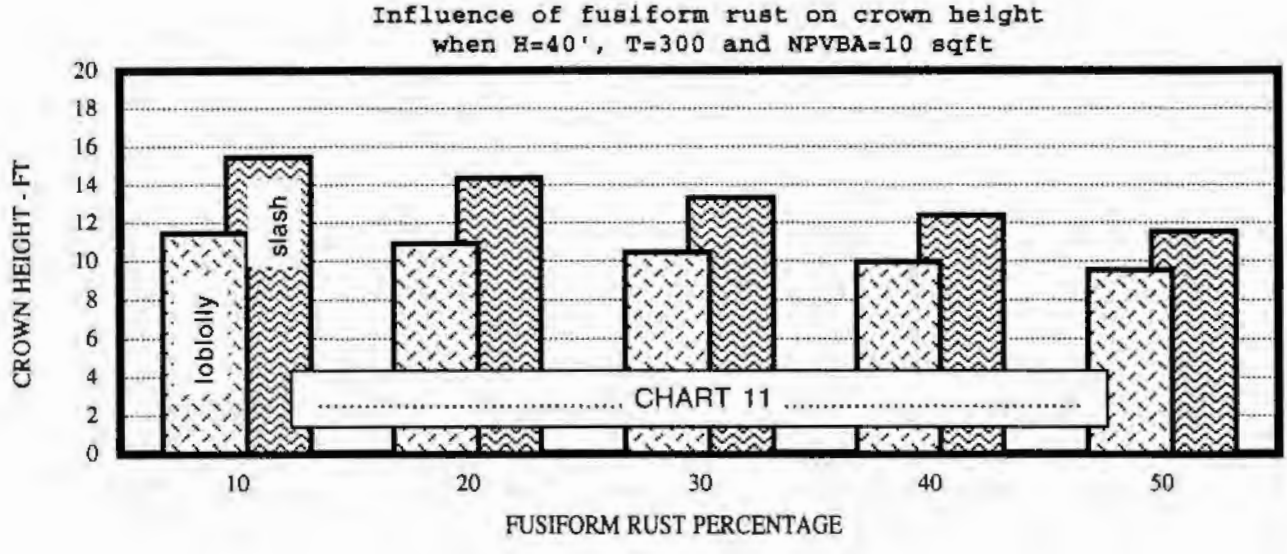
Influence of trees per acre on crown height
when H=40', R=50% and NPVBA=90 sqft

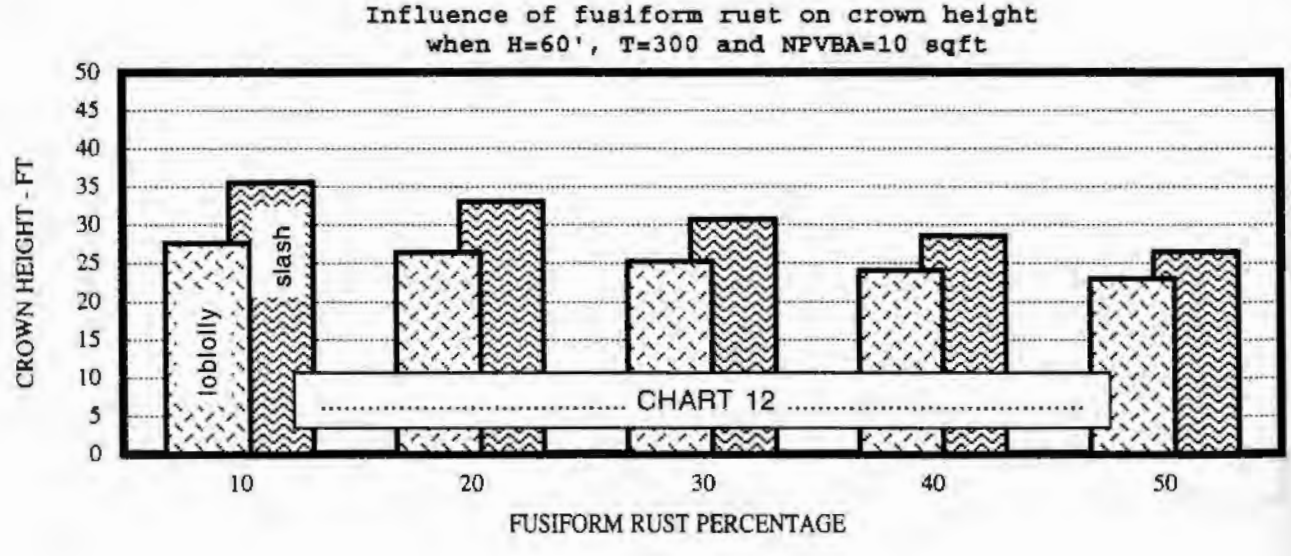


Influence of trees per acre on crown height
when H=60', R=50 and NPVBA=90 sqft

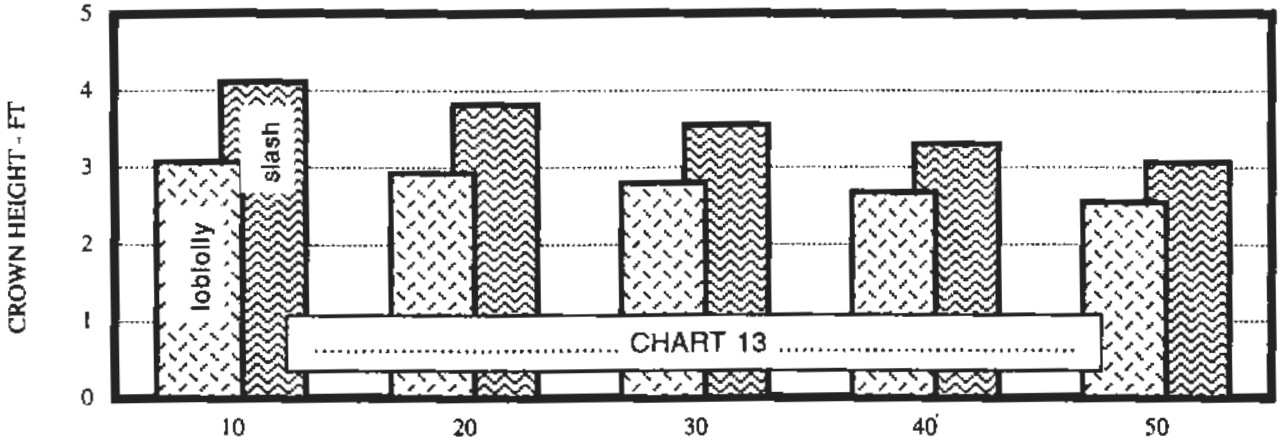



Influence of fusiform rust on crown height
when H=20', T=300 and NPVBA=10 sqft
CROWN HEIGHT - FT
0
1
2
3
4
5
loblolly
slash
CHART 10
10
20
30
40
50
FUSIFORM RUST PERCENTAGE

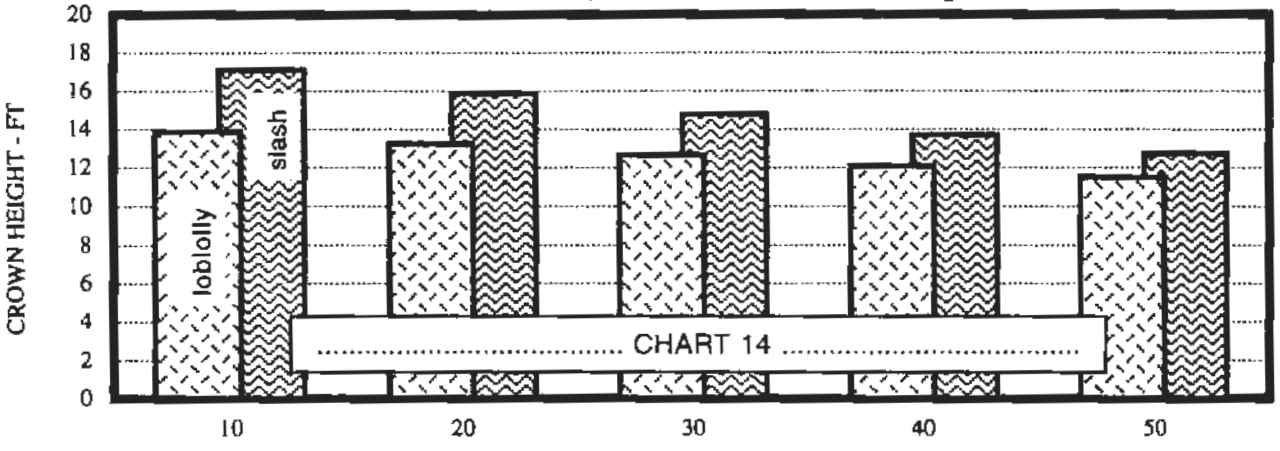

Influence of fusiform rust on crown height
when H=40', T=300 and NPVBA=10 sqft
CROWN HEIGHT - FT
0
2
4
6
8
10
12
14
16
18
20
loblolly
slash
CHART 11
10
20
30
40
50
FUSIFORM RUST PERCENTAGE


Influence of fusiform rust on crown height
when H=60', T=300 and NPVBA=10 sqft
CROWN HEIGHT - FT
0
5
10
15
20
25
30
35
40
45
50
loblolly
slash
CHART 12
10
20
30
40
50
FUSIFORM RUST PERCENTAGE

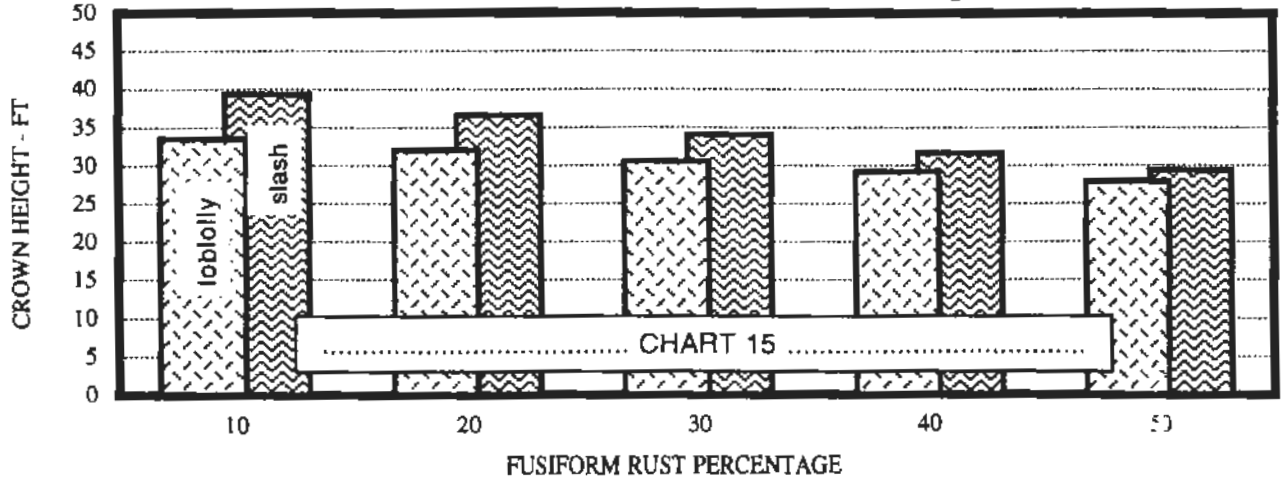
Influence of fusiform rust on crown height
when H=20', T=500 and NPVBA=50 sqft

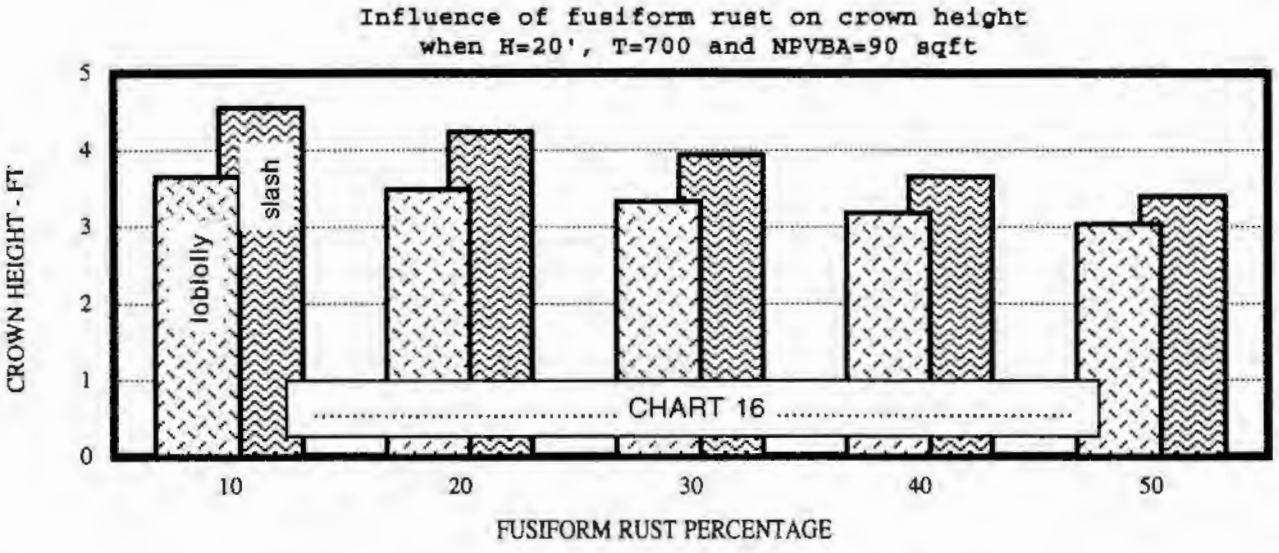


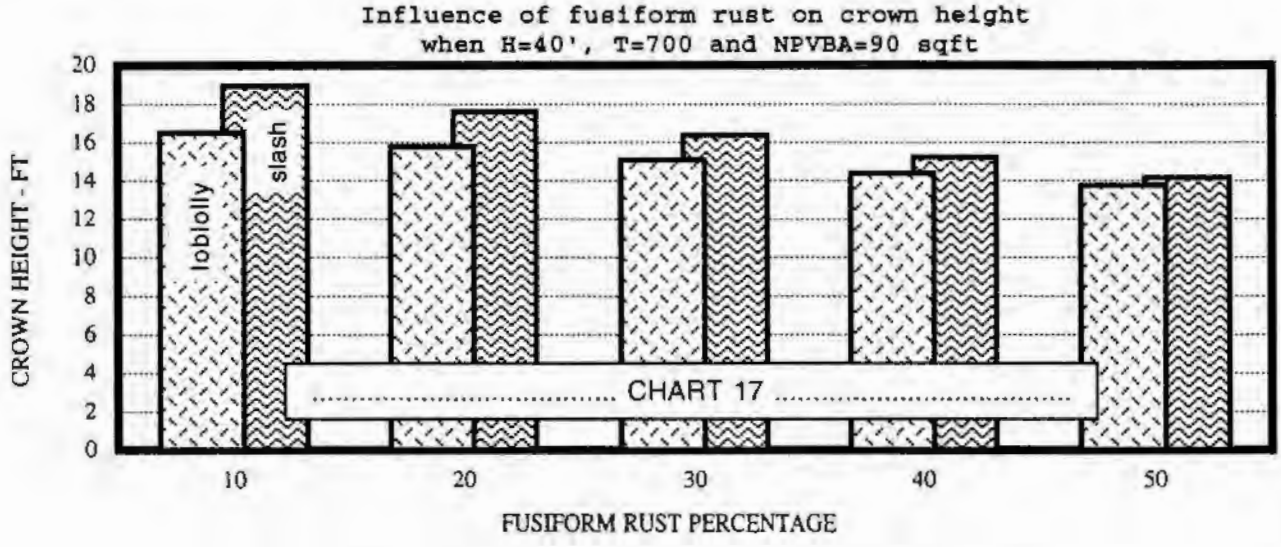
Influence of fusiform rust on crown height
when H=40', T=500 and NPVBA=50 sqft



Influence of fusiform rust on crown height
when H=60', T=500 and NPVBA=50 sqft




Influence of fusiform rust on crown height
when H=20', T=700 and NPVBA=90 sqft
CROWN HEIGHT - FT
0
1
2
3
4
5
loblolly
slash
CHART 16
10
20
30
40
50
FUSIFORM RUST PERCENTAGE


Influence of fusiform rust on crown height
when H=40', T=700 and NPVBA=90 sqft
CROWN HEIGHT - FT
0
2
4
6
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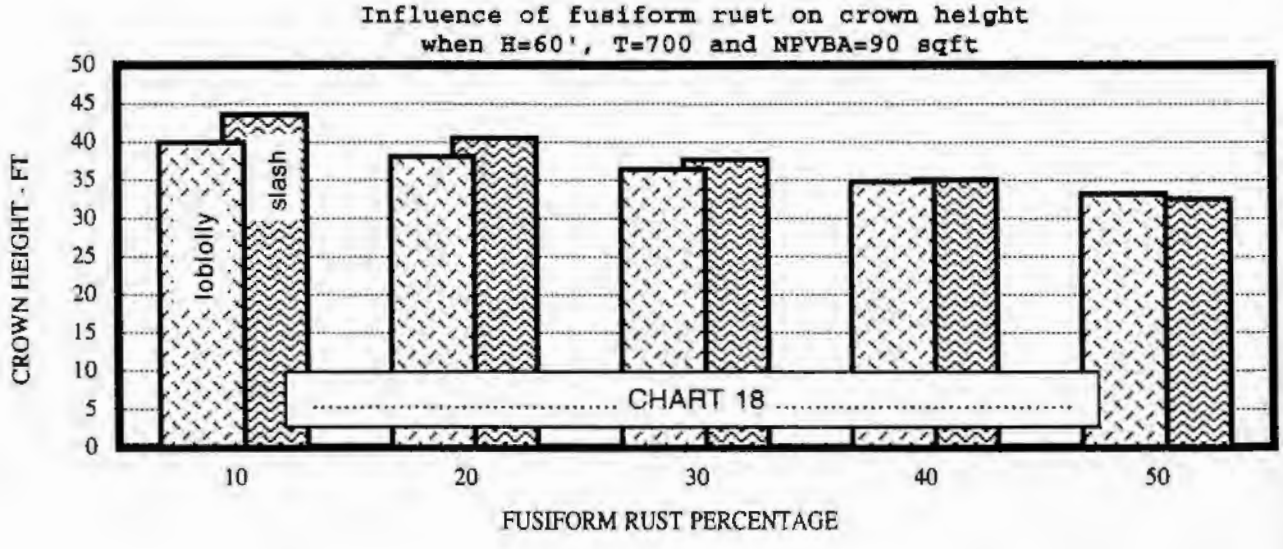
18
20
loblolly
slash
CHART 17
10
20
30
40
50
FUSIFORM RUST PERCENTAGE


Influence of fusiform rust on crown height
when H=60', T=700 and NPVBA=90 sqft
CROWN HEIGHT - FT
0
5
10
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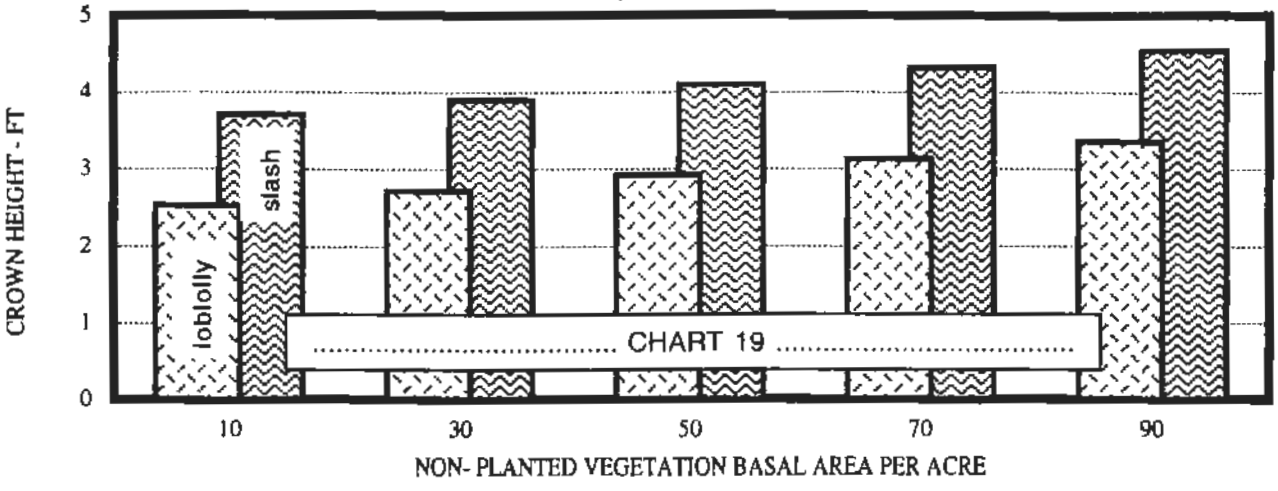
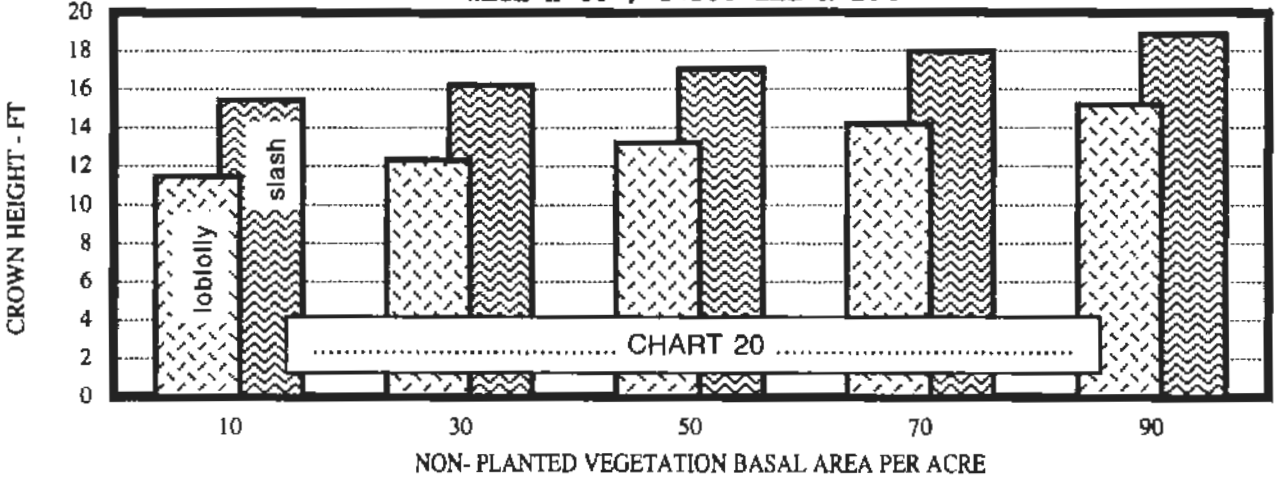
20
25
30
35
40
45
50
loblolly
slash
CHART 18
10
20
30
40
50
FUSIFORM RUST PERCENTAGE

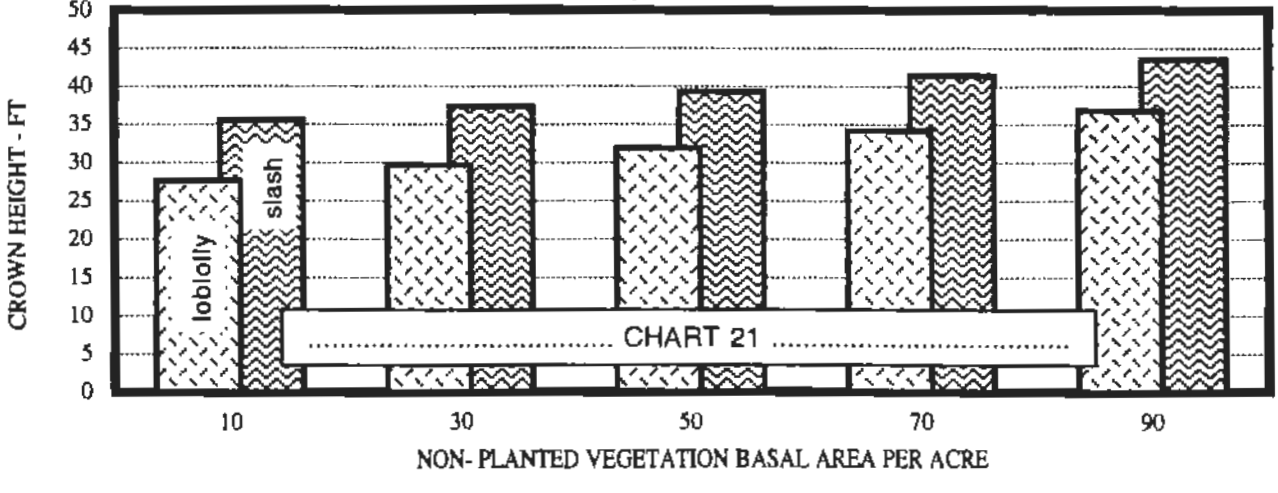
Influence of non-planted basal area per acre on crown height
when H=20', T=300 and R=10%



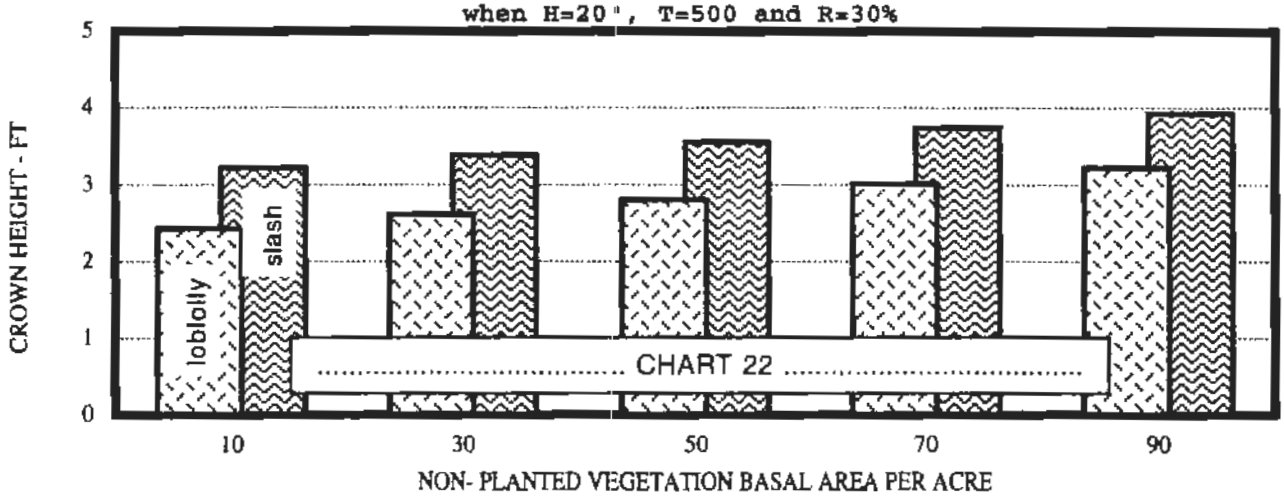
Influence of non-planted basal area per acre on crown height
when H=40', T=300 and R=10%



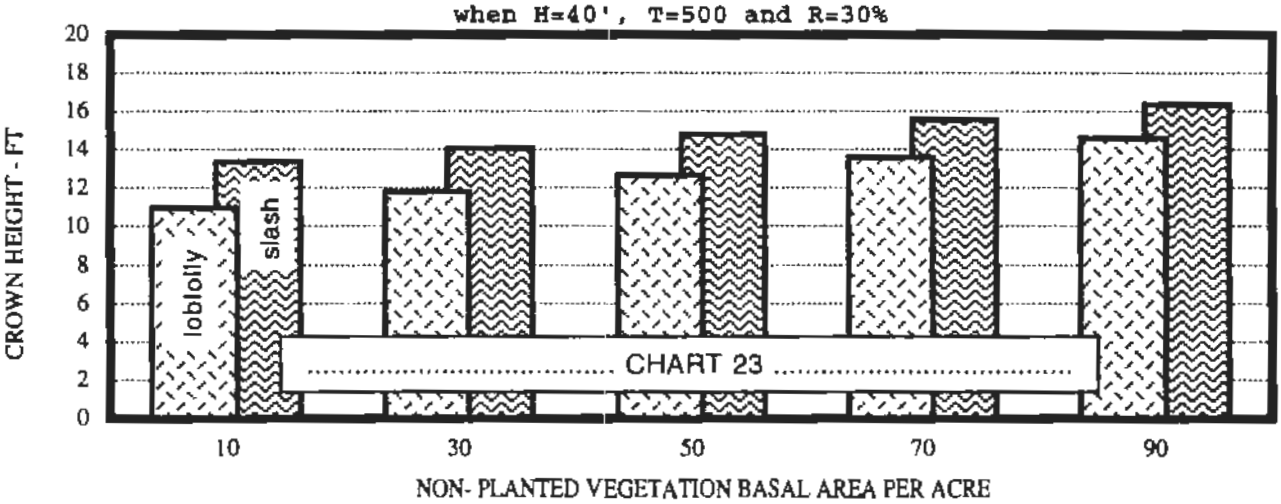
Influence of non-planted basal area per acre on crown height
when H=60', T=300 and R=10%



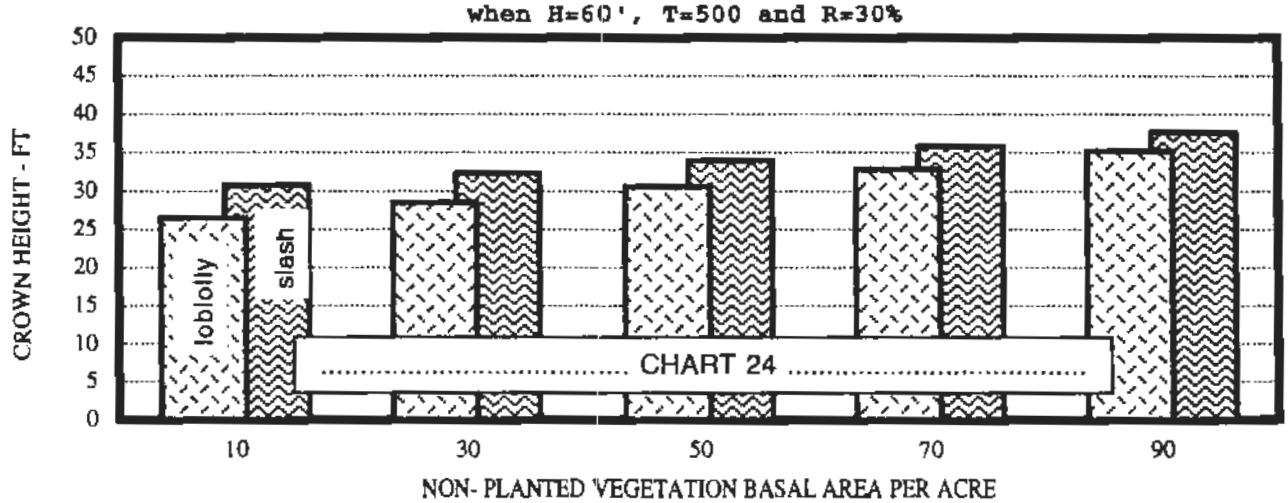
Influence of non-planted basal area per acre on crown height
when H=20', T=500 and R=30%



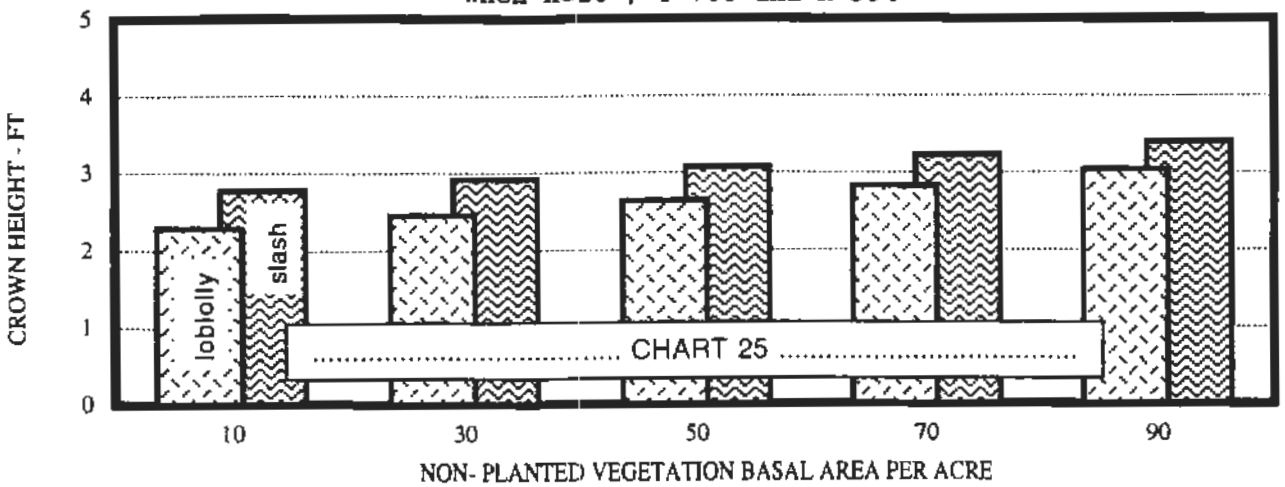
Influence of non-planted basal area per acre on crown height
when H=40', T=500 and R=30%



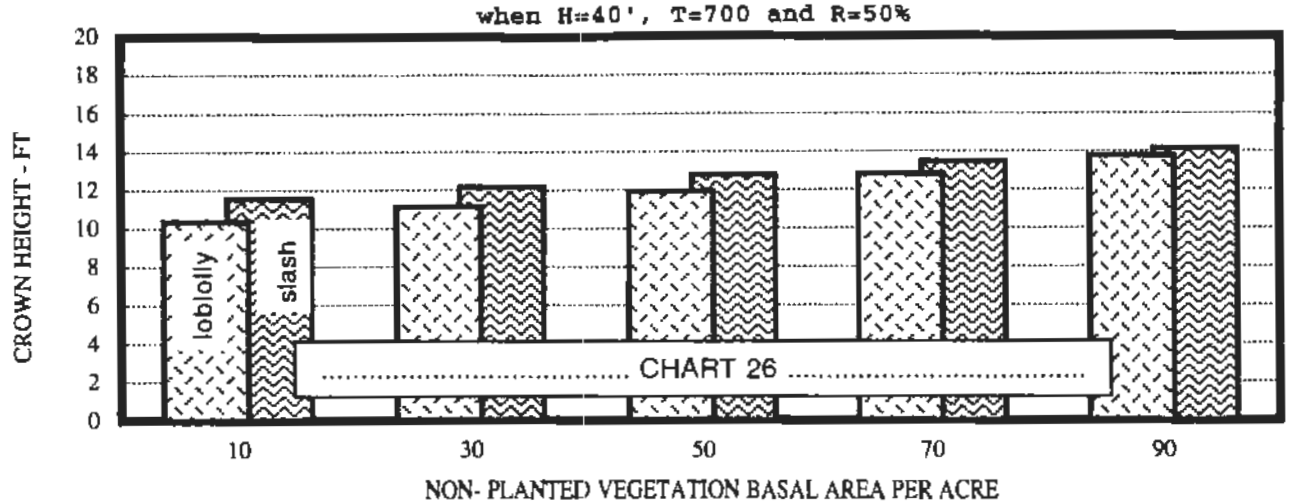
Influence of non-planted basal area per acre on crown height
when H=60', T=500 and R=30%



Influence of non-planted basal area per acre on crown height
when H=20', T=700 and R=50%



Influence of non-planted basal area per acre on crown height
when H=40', T=700 and R=50%



Influence of non-planted basal area per acre on crown height
when H=60', T=700 and R=50%