

Tree Growth in 1987, 1990 and 1991 Silvicultural Breed Trials

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Report No. 149

December 2007

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NOTE : Confidential to participants of the Stand Growth Modelling Cooperative.
: This is an unpublished report and must not be cited as a literature reference.

EXECUTIVE SUMMARY

Between 1987 and 1991, the Stand Growth Modelling Cooperative planted a series of trials (silviculture /breed trials) to examine how tree growth varied with silviculture and seedlot across different “growth modelling regions” and “site qualities” within New Zealand.

For the purpose of developing empirical models of tree growth, New Zealand was divided into “growth modelling regions”, and separate models developed for the different regions. There are eight regions which were used as a basis for locating the trials planted by the Stand Growth Modelling Cooperative. As well as region, four different site qualities were considered within each region:

This report documents the height and basal area growth for the trials planted in 1987, 1990 and 1991, and complements the analyses for the 1975 final crop stocking trials and 1978 genetic gains trials (see SGMC Report No. 123).

These results, from all three trial series, indicate that site and silvicultural treatment have a far greater influence on volume growth than improvements to seedlot. However volume growth is not the only variable that influences the value obtained for trees. Branching and wood property characteristics are also important in determining end use.

Tree Growth in 1987, 1990 and 1991 Silvicultural Breed Trials

J.C. Grace and M. Nagel

Introduction

Between 1987 and 1991, the Stand Growth Modelling Cooperative planted a series of trials (silviculture /breed trials) to examine how tree growth varied with silviculture and seedlot across different “growth modelling regions” and “site qualities” within New Zealand.

For the purpose of developing empirical models of tree growth, New Zealand was divided into “growth modelling regions”, and separate models developed for the different regions. These regions were used as a basis for locating the trials planted by the Stand Growth Modelling Cooperative. The regions are:

- Auckland Clays
- Sands
- Central North Island
- Hawkes Bay
- East Coast
- Nelson
- Canterbury
- Southland

As well as region, four different site qualities were considered within each region:

- Low site index
- Medium site index
- High site index
- High basal area

This report documents the height and basal area growth for the trials planted in 1987, 1990 and 1991, and complements the analyses for the 1975 final crop stocking trials and 1978 genetic gains trials (see SGMC Report No. 123).

1987 silvicultural / breed trials

Six trials were planted in 1987 (see Table 1). Within the 1987 trials there were four common seedlots:

- GF7
- GF14
- GF21
- LI28 (GF13), a long internode seedlot

For each seedlot there were six common treatments that have been considered (see Table 2). Thinning in treatments 1-4 was prescribed to take place at 6.2m MCH and in treatment 6 at 20m MCH. The actual MCH at thinning is shown in Table 1.

Table 1. Location of the 1987 silvicultural/ breed trials.

Region	Site Quality	Forest	Trial Number	Mean Site Index (from PSP)	MCH at thinning	
					Trt 1-4	Trt 6
Sands	Medium site index	Woodhill	FR7	27.0	6.9	19.9
Central North Island	Medium site index	Tahorakuri	FR8	33.3	6.0	-
Central North Island	Low site index	Kaingaroa	FR9	23.9	6.6	19.1
Hawkes Bay	High basal area	Glengarry	FR10	34.7	7.2	-
Nelson	Low site index	Ditchlings	FR11	28.9	6.6	19.4
Southland	High basal area	Otago Coast	FR12	24.2	6.1	18.9

Table 2. Treatments considered from the 1987 silvicultural/ breed trials.

Treatment	Initial stems/ha	Final stems/ha	Prescribed mean crop height (MCH) at time of thinning (m)	Pruning (at time of thinning)
1	500	100	6.2	Crown remaining 4m
2	500	200	6.2	Crown remaining 4m
3	1000	400	6.2	Crown remaining 4m
4	1500	600	6.2	Crown remaining 4m
5	500	500	-	Unpruned
6	500	200	20	Crown remaining 4m

Further details of these trials are given in SGMC Reports 100 and 103.

1990 silvicultural / breed trials

Six trials were planted in 1990 (see Table 3). Within the 1990 trials there were five common seedlots:

- GF7
- GF14
- GF16
- GF25
- LI28 (GF13), a long internode seedlot
(this seedlot was not planted at Tairua - FR 121/4 or Huanui - FR 121/7)

There were six common treatments across sites (Table 4), but not all the treatment × seedlot combinations were planted. Thinning in all treatments was prescribed to take place at 6.2m MCH. The actual MCH at thinning is shown in Table 3.

Table 3. Location of the 1990 silvicultural / breed trials.

Region	Site Quality	Forest	Trial Number	Mean Site Index (from PSP)	Actual MCH at thinning
Auckland Clays	Medium site index	Tungrove	FR121/1	31.1	7.2
Central North Island	Medium site index	Kinleith	FR121/2	37.8	7.1
Hawkes Bay	Low site index	Gwavas	FR121/3	29.5	6.5
Auckland Clays	High site index	Tairua	FR121/4	34.1	7.3
Central North Island	High site index	Tarawera	FR121/6	33.2	7.0
East Coast	High basal area	Huanui	FR121/7	31.0	6.0

Table 4. Treatments considered from the 1990 silvicultural/ breed trials.

Treatment	Initial stems/ha	Final stems/ha	Prescribed mean crop height (MCH) at time of thinning (m)	Pruning (at time of thinning)
1	250	100	6.2	Crown remaining 4m
2	500	200	6.2	Crown remaining 4m
3	1000	400	6.2	Crown remaining 4m
4	500	200	6.2	Unpruned
5	1000	400	6.2	Unpruned
6	1000	600	6.2	Unpruned

Further details of these trials are given in SGMC Reports 100 and 103.

1991 silvicultural / breed trials

Six trials were planted in 1991 (see Table 5). Within the 1991 trials there were five common seedlots:

- GF7
- GF14
- GF16
- GF25
- LI28 (GF13), a long internode seedlot

For each seedlot there were six common treatments across sites (Table 6) but not all the treatment × seedlot combinations were planted. Thinning in all treatments was prescribed to take place at 6.2m MCH. The actual MCH at thinning is shown in Table 5.

Table 5. Location of 1991 silvicultural / breed trials.

Region	Site Quality	Forest	Trial Number	Mean Site Index (from PSP)	Actual MCH at thinning
East Coast	Medium site index	Mangatu	FR121/8	32.5	6.6
Sands	Low site index	Santoft	FR121/9	22.3	6.2
Southland	Low site index	Blue Mountains	FR121/10	24.1	7.1
Canterbury	Low site index	Shellocks	FR121/11	23.1	7.1
Canterbury	High site index	Ashley	FR121/12	27.6	5.9
Nelson	High site index	Golden Downs	FR121/13	30.3	6.9

Table 6. Treatment considered from 1991 silvicultural / breed trials.

Treatment	Initial stems/ha	Final stems/ha	Prescribed mean crop height (MCH) at time of thinning (m)	Pruning (at time of thinning)
1	250	100	6.2	Crown remaining 4m
2	500	200	6.2	Crown remaining 4m
3	1000	400	6.2	Crown remaining 4m
4	500	200	6.2	Unpruned
5	1000	400	6.2	Unpruned
6	1000	600	6.2	Unpruned

Further details of these trials are given in SGMC Reports 100 and 103.

Results

1987 silvicultural / breed trials

In the 1987 silviculture/breed trials there were only small differences in mean top height between treatments (**Figure 1**). Treatment 1 (FCS 100 sph) shows consistently lower mean top height growth and basal area growth while treatment 4 (FCS 600 sph) shows consistently higher mean top height growth (**Figure 1**). Treatments 4 (FCS 600 sph) and 5 (FCS 500 sph) consistently produce more basal area growth across all sites (**Figure 2**). Treatment 6 (FCS 200 sph) shows the decrease in basal area associated with the late thin at 20m (**Figure 2**). Looking at the graphs on a treatment basis labelled by site (**Figure 3** and **Figure 4**), it can be noted that treatment 6 was only carried out at 4 out of the 6 sites. SD (Otago Coast) tends to have the lowest mean top height growth, with RO1 (Tahorakuri) and HB (Glengarry) having consistently the highest mean top height growth (**Figure 3**). HB has the highest basal area growth with RO2 (Kaingaroa) showing the lowest basal area growth (**Figure 4**). When we look at the data labelled by GF rating (**Figure 5** and **Figure 6**), GF21 and GF14 show best mean top height and basal area growth however there is not much variation. It is interesting to note that variation was greatest at the Otago Coast site (Low SI).

1990 silvicultural / breed trials

While the 1990 trials show minimal spread in mean top height (**Figure 7**) there is much variation in basal area (**Figure 8**). If we look at the trends in basal area with age for each site, labelled by treatment this wide variation is very evident and indicates that much can be achieved via silvicultural treatment. Looking at the 1990 trials on a treatment basis labelled by site RO2 (Tarawera) has consistently the highest mean top height with HB (Gwavas) showing the lowest (**Figure 9**). Basal area was generally highest at the EC (Huanui) site and lowest at the AK2 (Tairua) site (**Figure 10**). It should be noted that treatment 1 was only carried out at 3 of the 6 locations. When the data is labelled by GF rating, we see that the effect of seedlot on mean top height is minimal (**Figure 11**) and there are only small variances in basal area (**Figure 12**).

1991 silvicultural / breed trials

The 1991 trials again show little spread in mean top height when labelled by treatment (**Figure 13**). Treatments 3 (FCS 400 sph) and 6 (FCS 600 sph) appear to consistently produce the greatest mean top height with treatment 1 (FCS 100 sph) producing the lowest. Treatment 6 appears to produce the largest basal area with treatment 1 again producing the lowest (**Figure 14**). The graphs for two of the sites (Mangatu and Blue Mountain) show a decrease in basal area for some of the treatments, indicating a possible unscheduled thinning. The EC (Mangatu) site shows the best height and basal area growth while the CY2 (Ashley) site shows the worst (**Figure 15** and **Figure 16**). Again there is not much variation between the different GF rated seedlots, there being no one consistent leader in either height or basal area growth (**Figure 17** and **Figure 18**).

Discussion

Graphs have been plotted showing trends in mean top height and basal area for the 1987, 1990 and 1991 silviculture / breed trials managed by the Stand Growth Modelling Cooperative. Similar results are apparent for all 3 series of trials:

- Little variation in mean top height with silvicultural treatment, although the FCS 100sph tends to be lower
- Little variation in mean top height between with seedlot for a common silvicultural treatment (treatment 2, planted at 500 stems/ha and thinned to 200 stems/ha at mean crop height of 6.2 m)
- Obvious variation in basal area growth with silvicultural treatment
- Small variations in basal area growth with seedlot for a common silvicultural treatment (treatment 2, planted at 500 stems/ha and thinned to 200 stems/ha at mean crop height of 6.2 m)
- Obvious variations in mean top height and basal area with site conditions for a common silvicultural treatment.

These results indicate that site and silvicultural treatment have a far greater influence on volume growth than improvements to seedlot. However volume growth is not the only variable that influences the value obtained for trees. Branching and wood property characteristics are also important in determining end use.

To provide information on branching characteristics, PhotoMARVL /TreeD studies are being carried out in these trials when they reach a suitable height for such studies to be carried out. Up until August 2007, PhotoMARVL / TreeD studies have been carried out in the following trials:

1987 silvicultural / breed trials

- FR8 (see SGMC Report No.133)
- FR10 (see SGMC Report No.133)

1990 silvicultural / breed trials

- FR121/1 (see SGMC Report No.142)
- FR121/2 (see SGMC Report No.148)
- FR121/3 (see SGMC Report No.142)
- FR121/4 (see SGMC Report No.135)
- FR121/7 (see SGMC Report No.135)

1991 silvicultural /breed trials

- FR121/13 (see SGMC Report No.142)

Information on stem damage in these trials is summarised in SGMC Report No. 138.

Destructive sampling for measuring wood properties has not been carried out in these trials as the current aim is to hold the trials to rotation age. The exception is FR121/11 which was clearfelled for farming (see SGMC Report No.139)

Appendix 1. 1987 silvicultural / breed trials.

Figure 1. Trends in mean top height with age for each site, labelled by treatment.

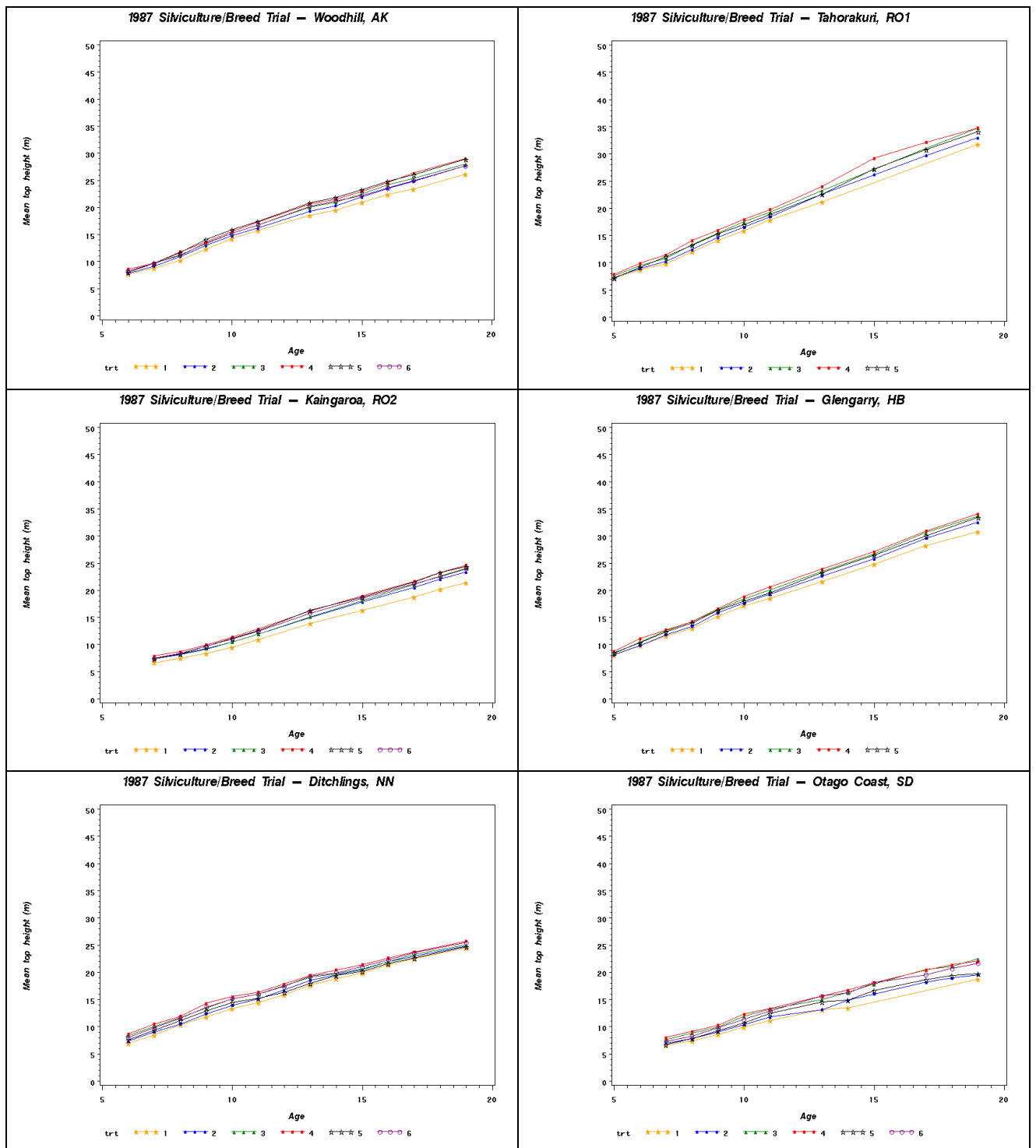


Figure 2 Trends in basal area with age for each site, labelled by treatment.

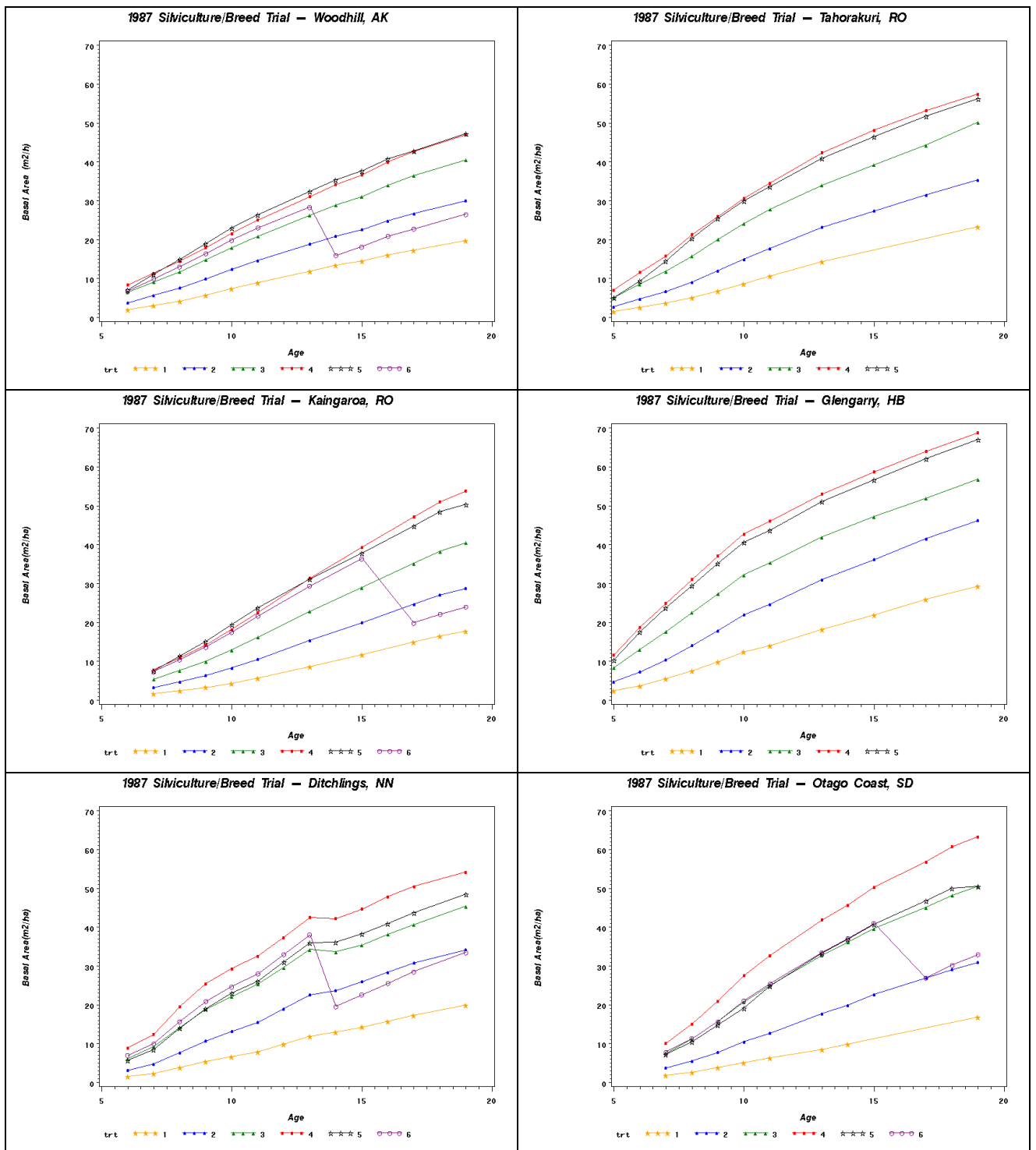


Figure 3. Trends in mean top height with age for each treatment, labelled by site.

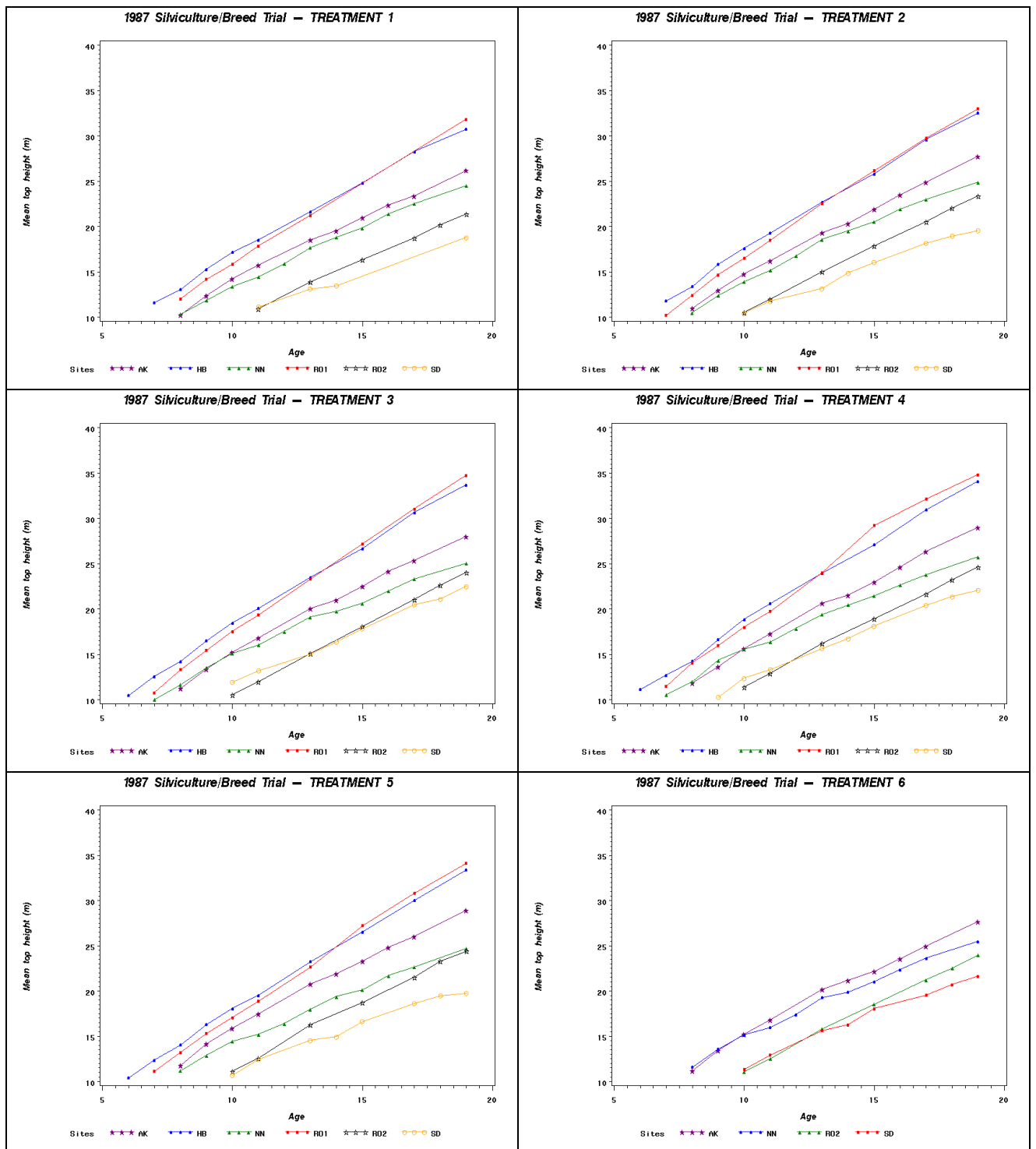


Figure 4. Trends in basal area with age for each treatment, labelled by site.

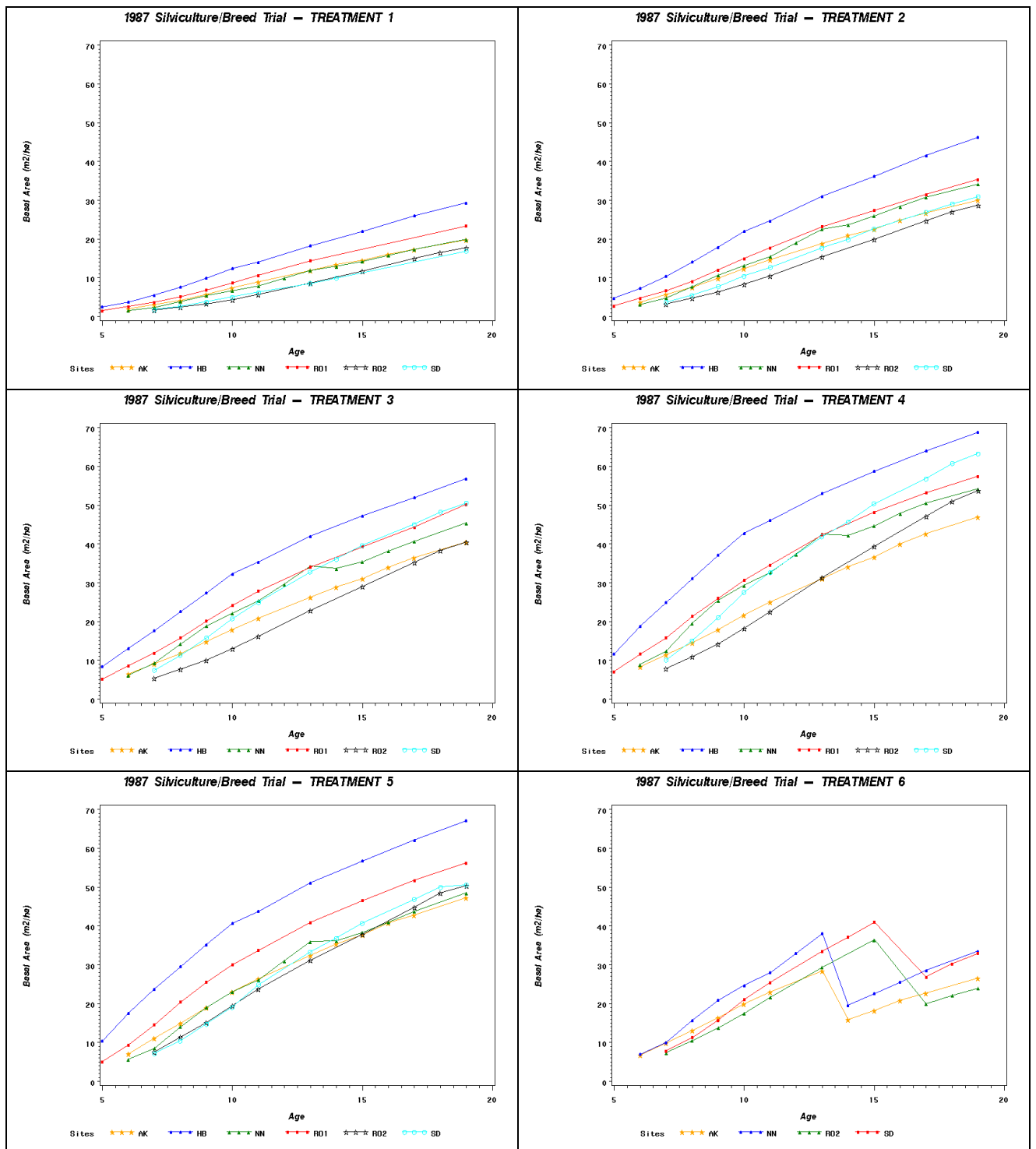


Figure 5. Trends in basal area with age for each site, labelled by GF rating.

Treatment 2 data is used exclusively since it is only in treatment 2 that all GF seed lots are present

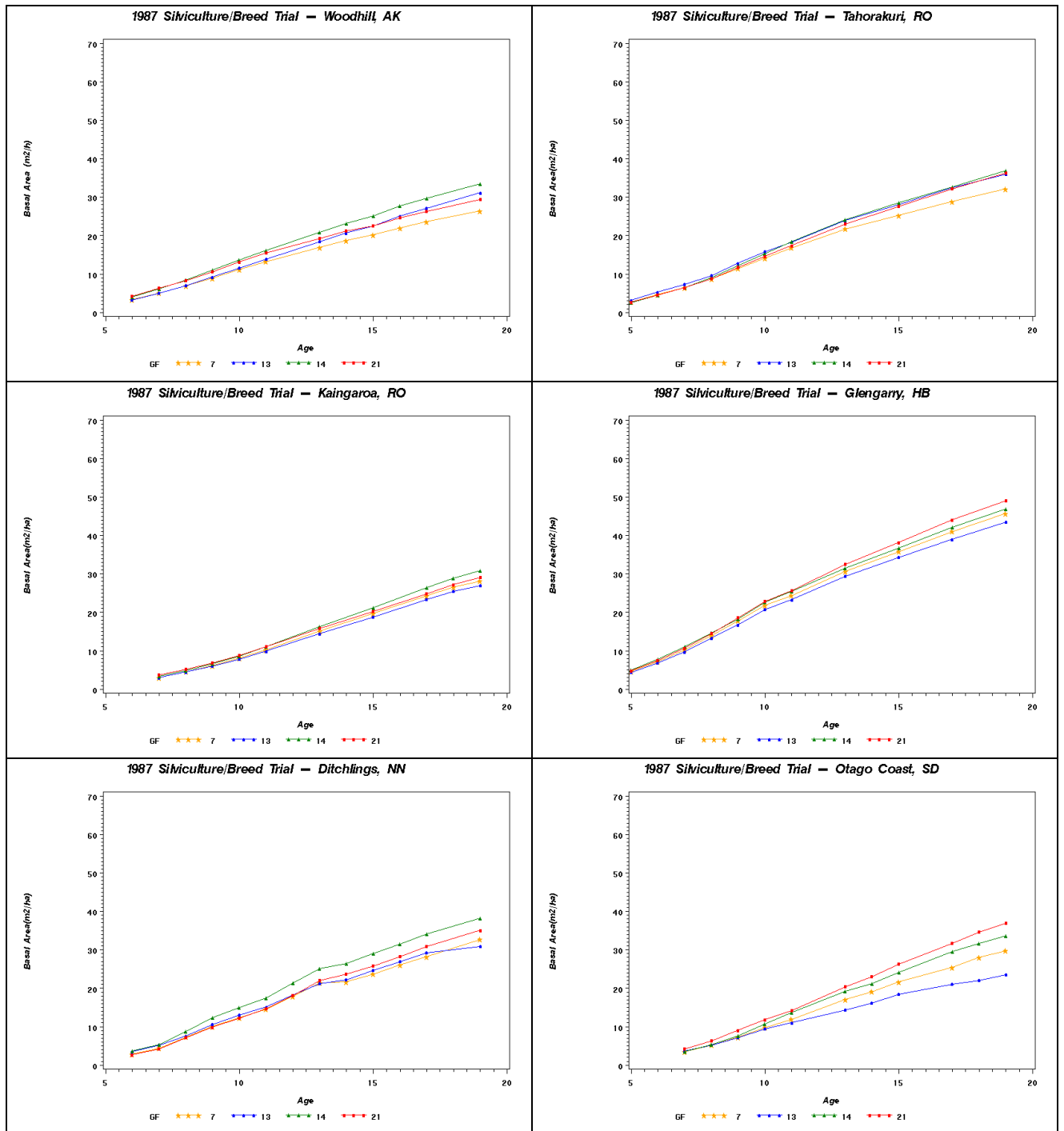
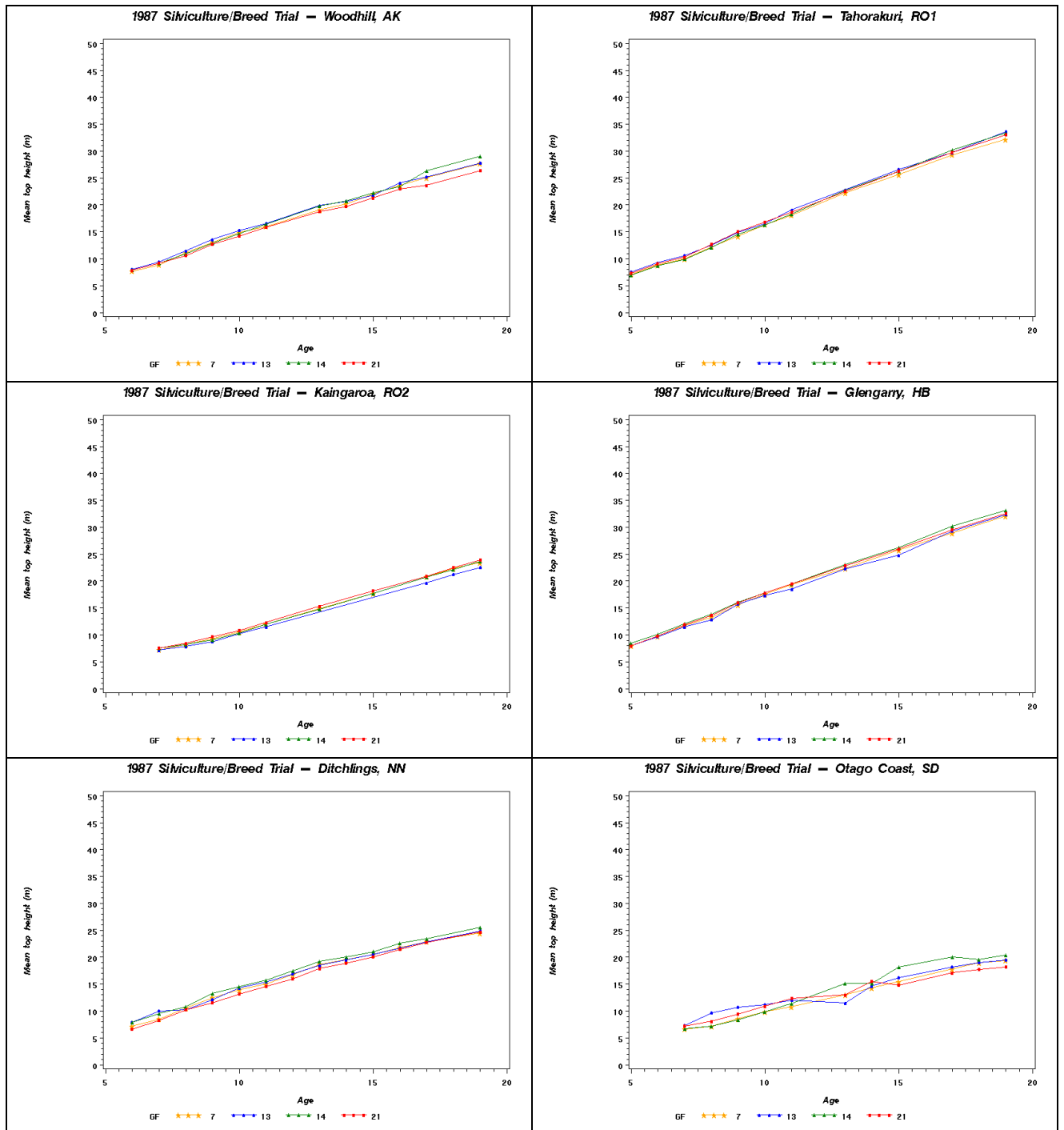


Figure 6. Trends in mean top height with age for each site, labelled by GF rating.

Treatment 2 data is used exclusively since it is only in treatment 2 that all GF seed lots are present



Appendix 2. 1990 Silviculture/Breed trials.

Figure 7. Trends in mean top height with age for each site, labelled by treatment.

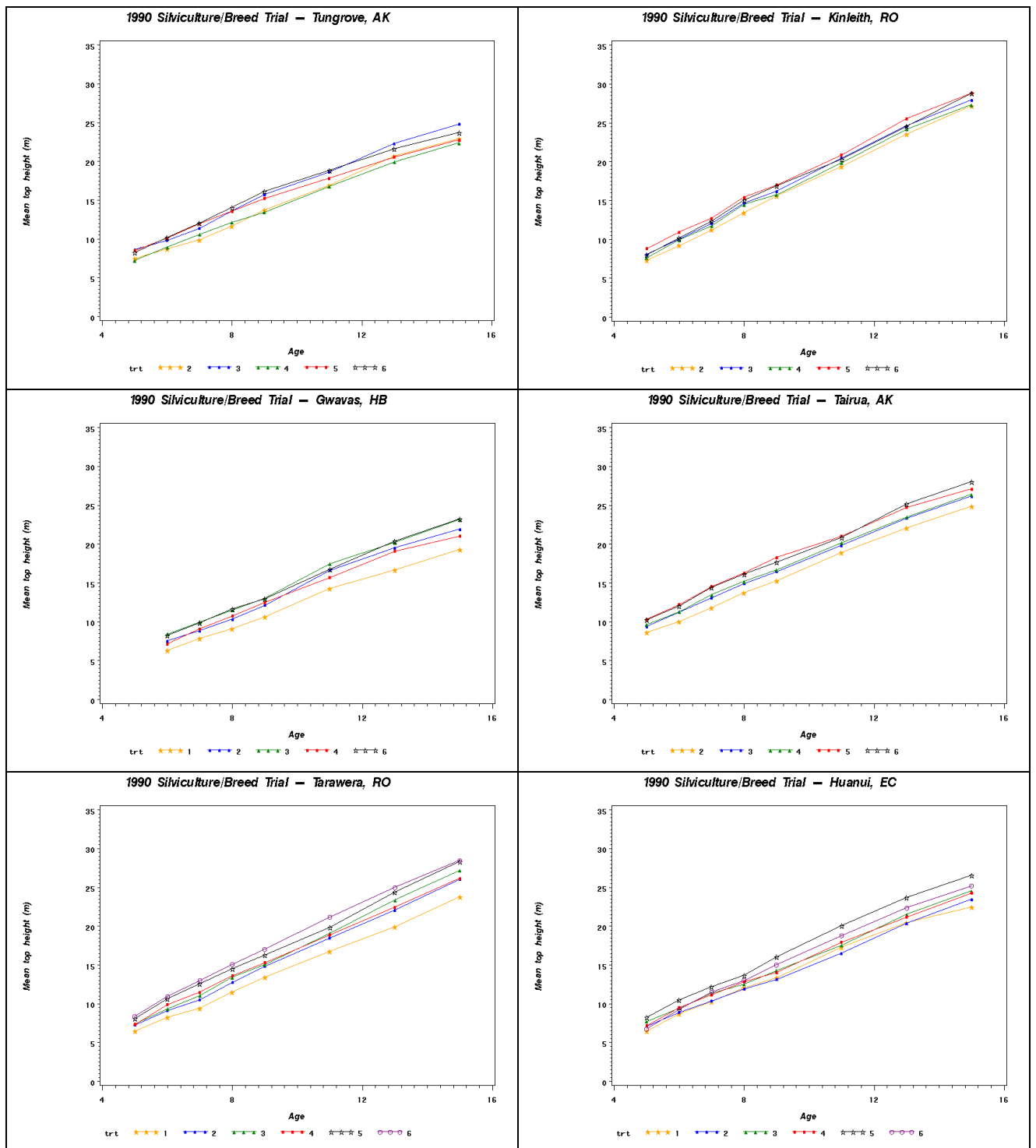


Figure 8. Trends in basal area with age for each site, labelled by treatment.

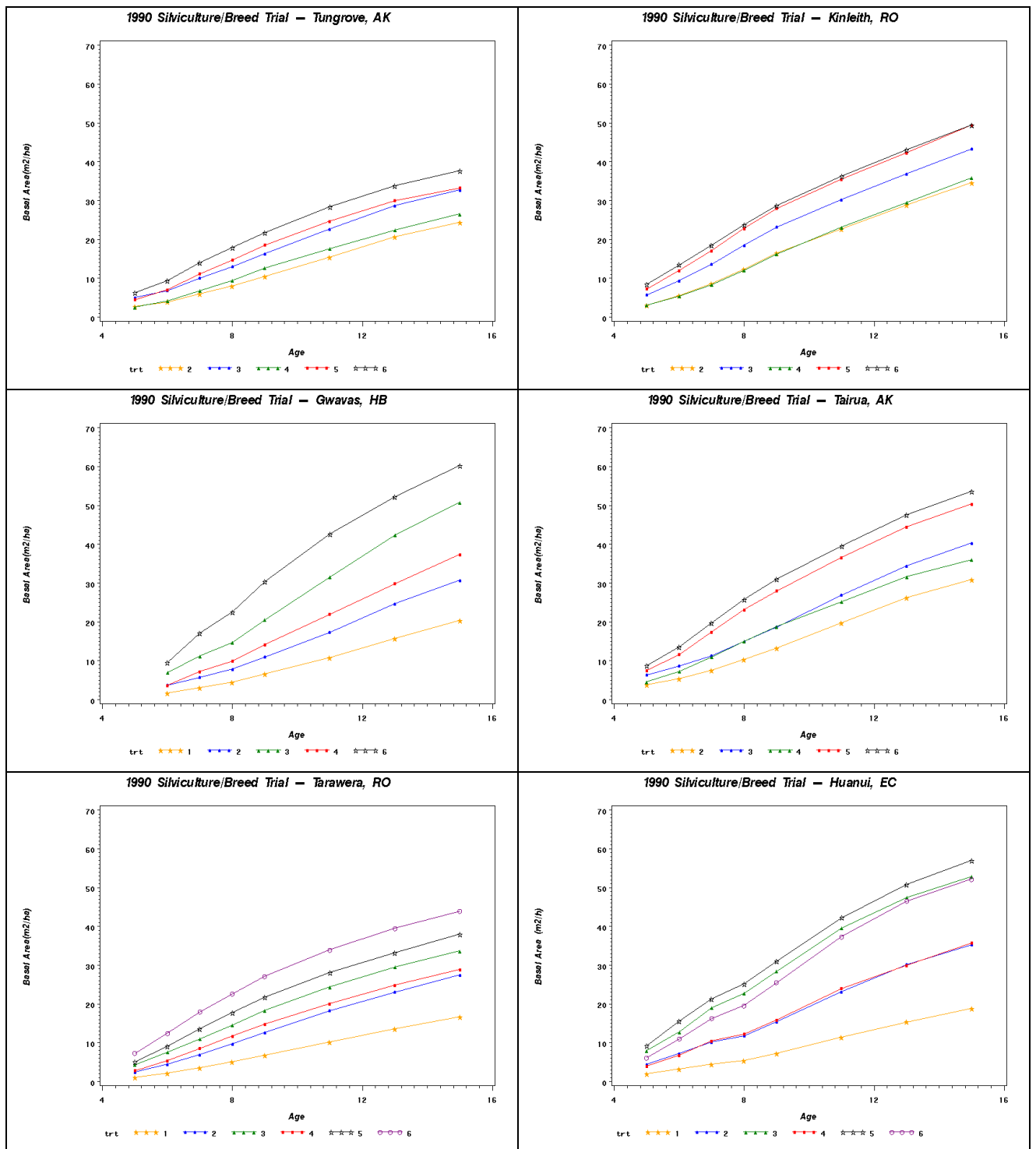


Figure 9. Trends in mean top height with age for each treatment, labelled by site.

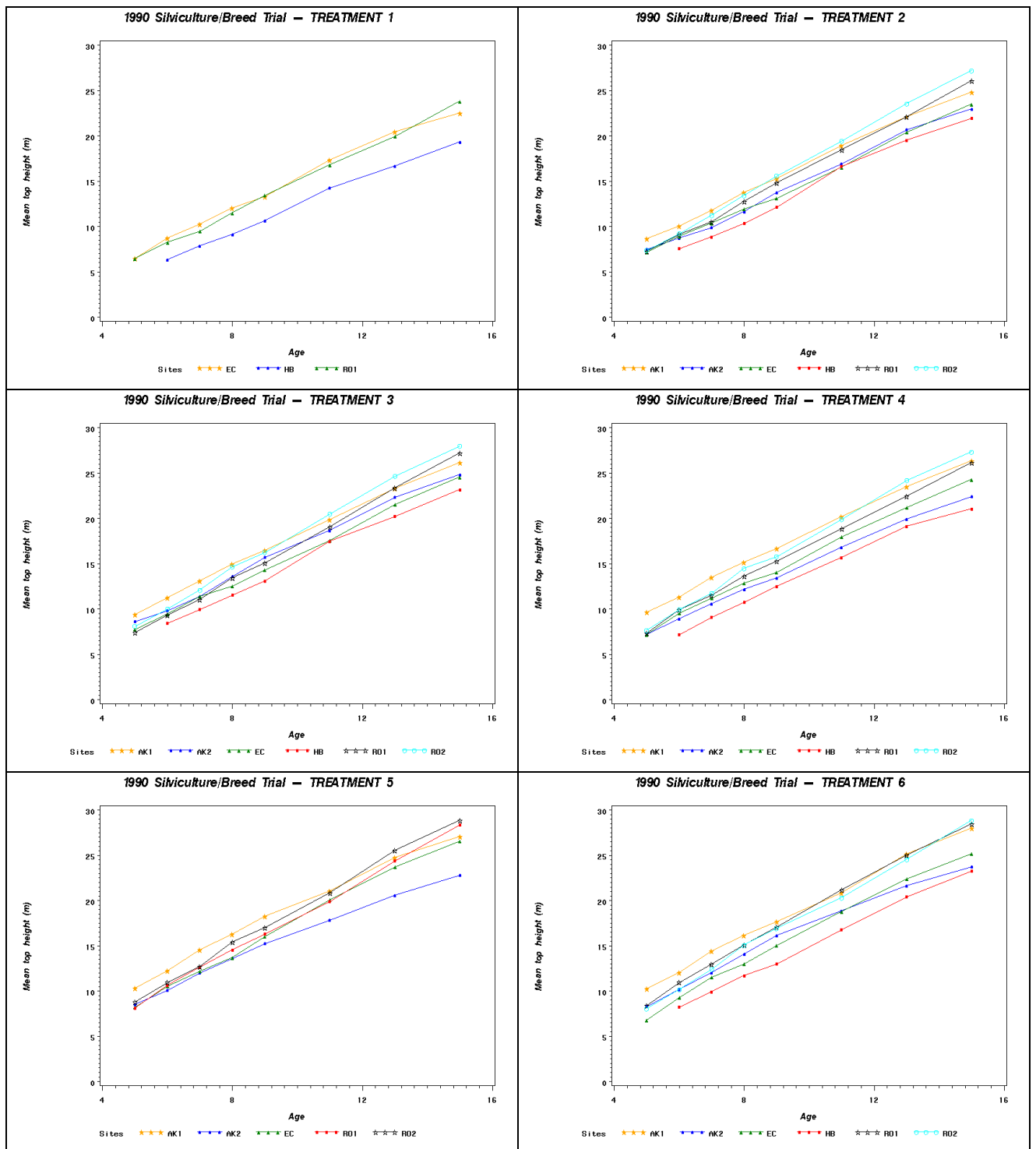


Figure 10. Trends in basal area with age for each treatment, labelled by site.

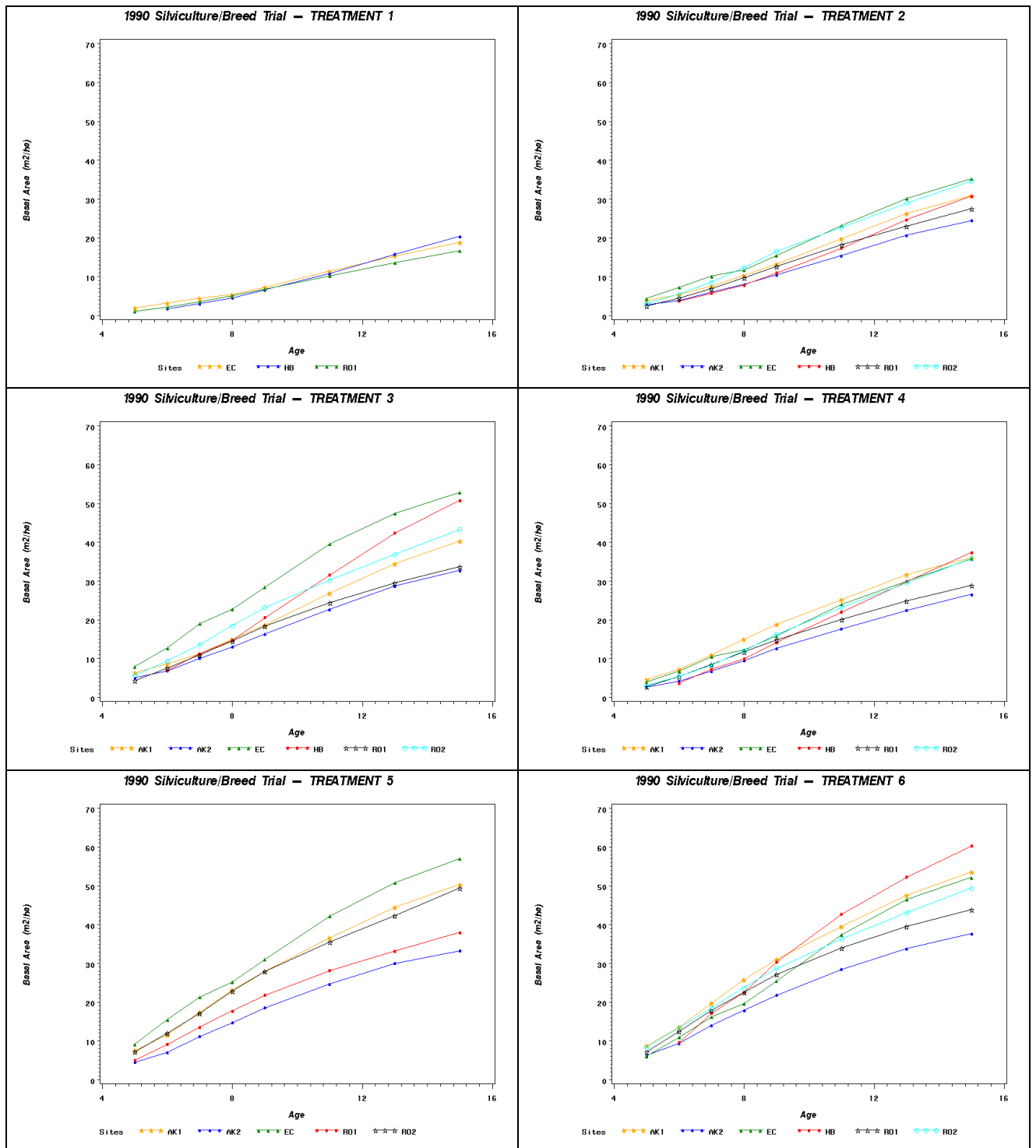


Figure 11. Trends in mean top height with age for each site, labelled by GF rating.
 Treatment 2 data is used exclusively since it is only in treatment 2 that all GF seed lots are present

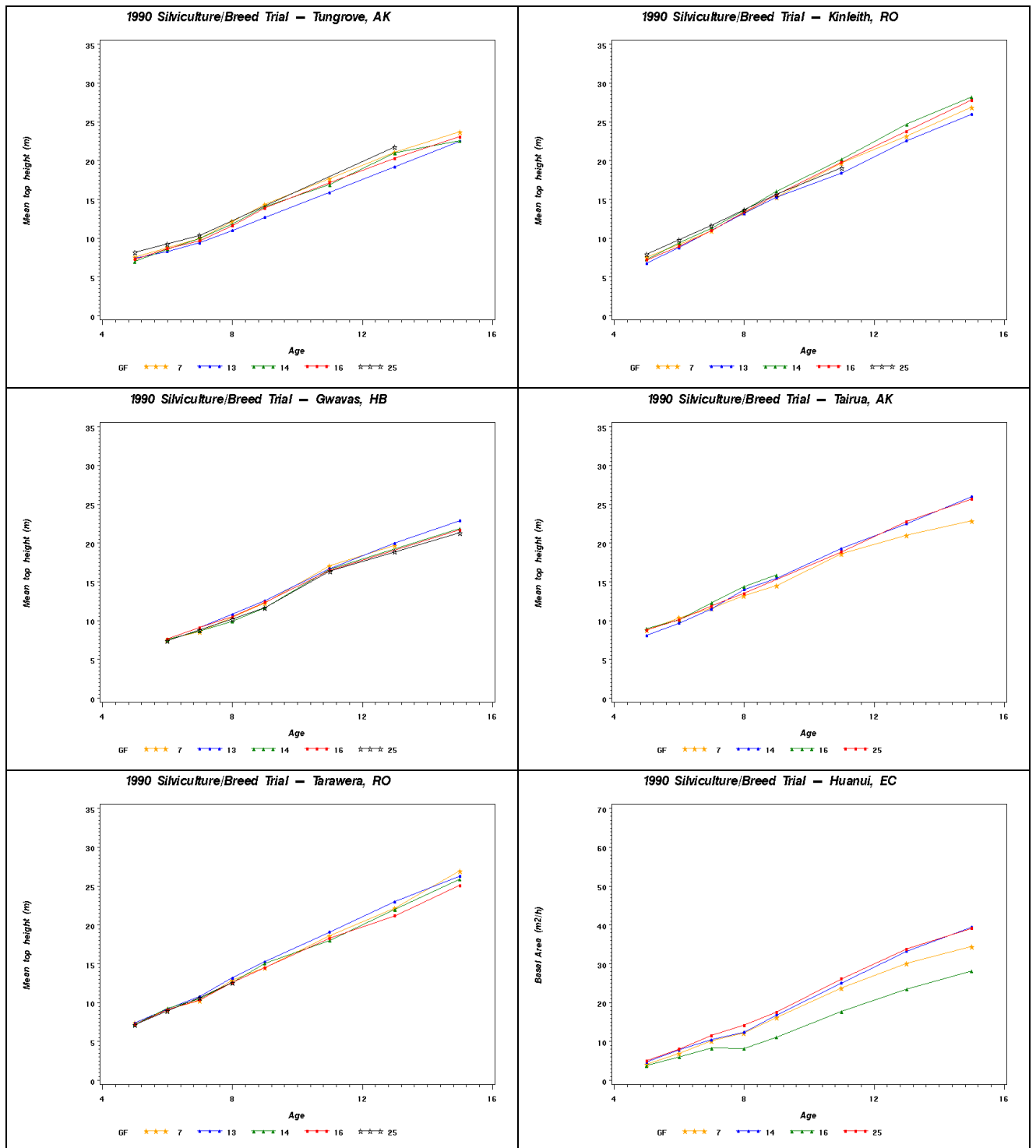
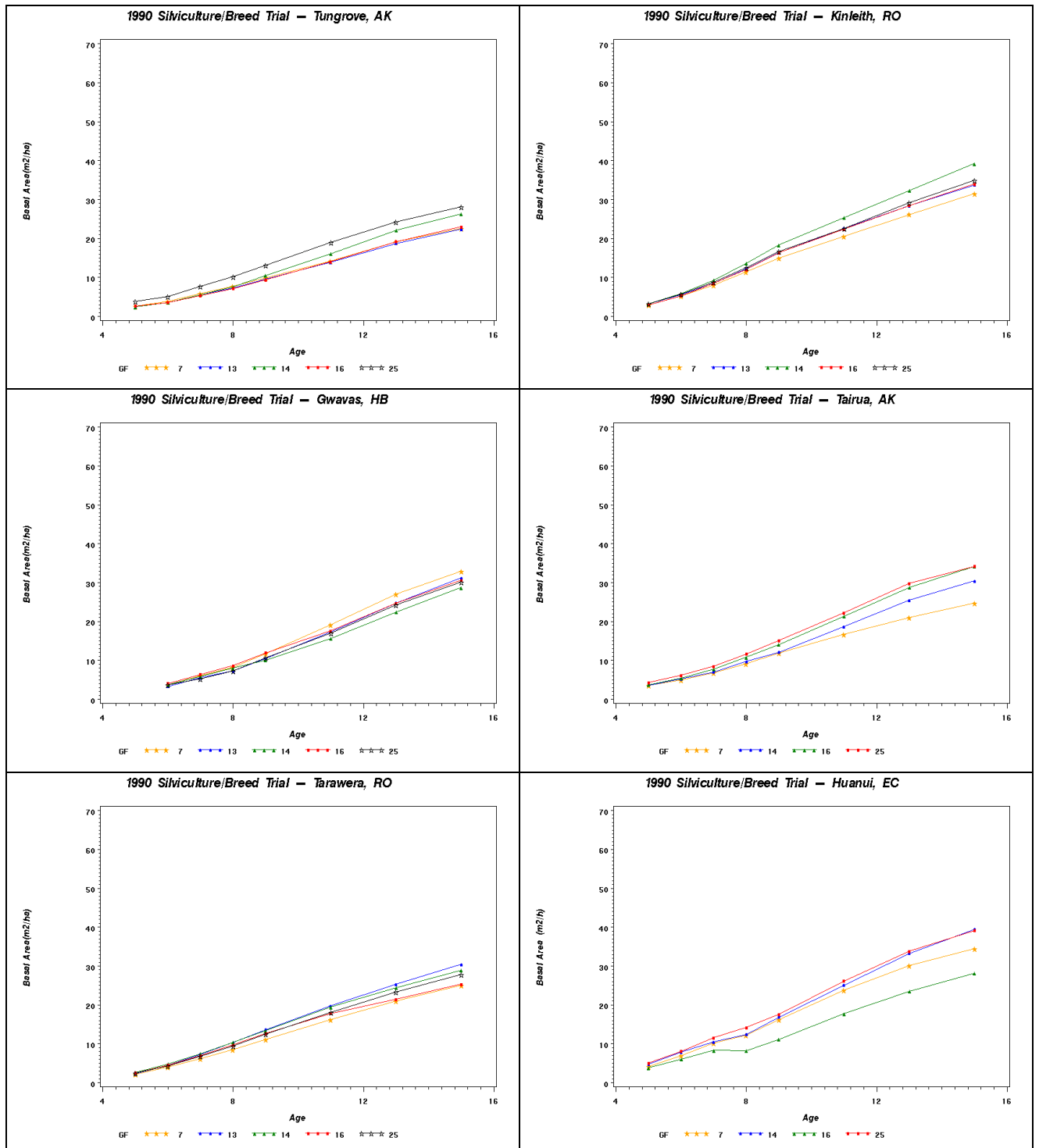


Figure 12. Trends in basal area with age for each site, labelled by GF rating.

Treatment 2 data is used exclusively since it is only in treatment 2 that all GF seed lots are present



Appendix 3. 1991 Silviculture/Breed trials

Figure 13. Trends in mean top height with age for each site, labelled by treatment.

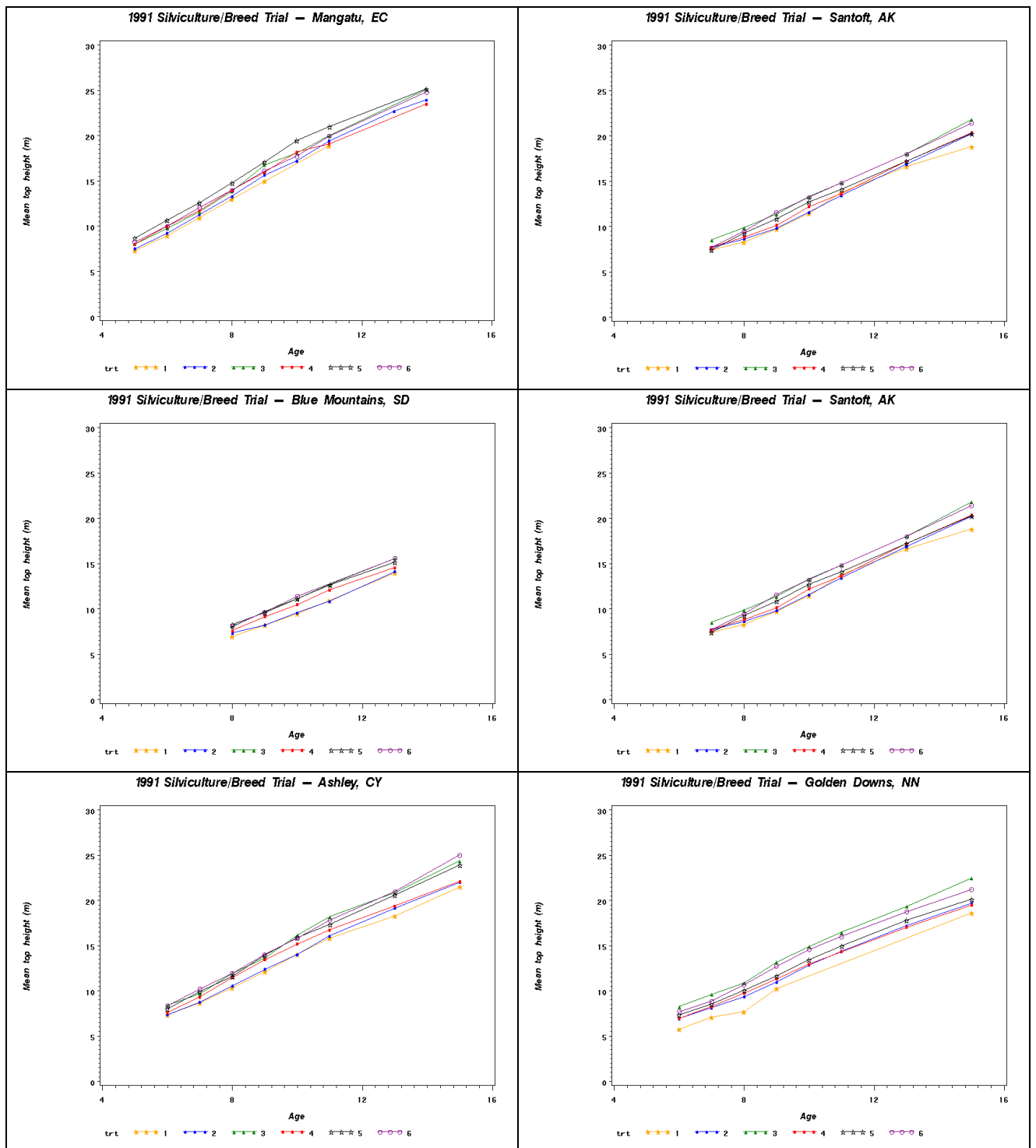


Figure 14. Trends in basal area with age for each site, labelled by treatment.

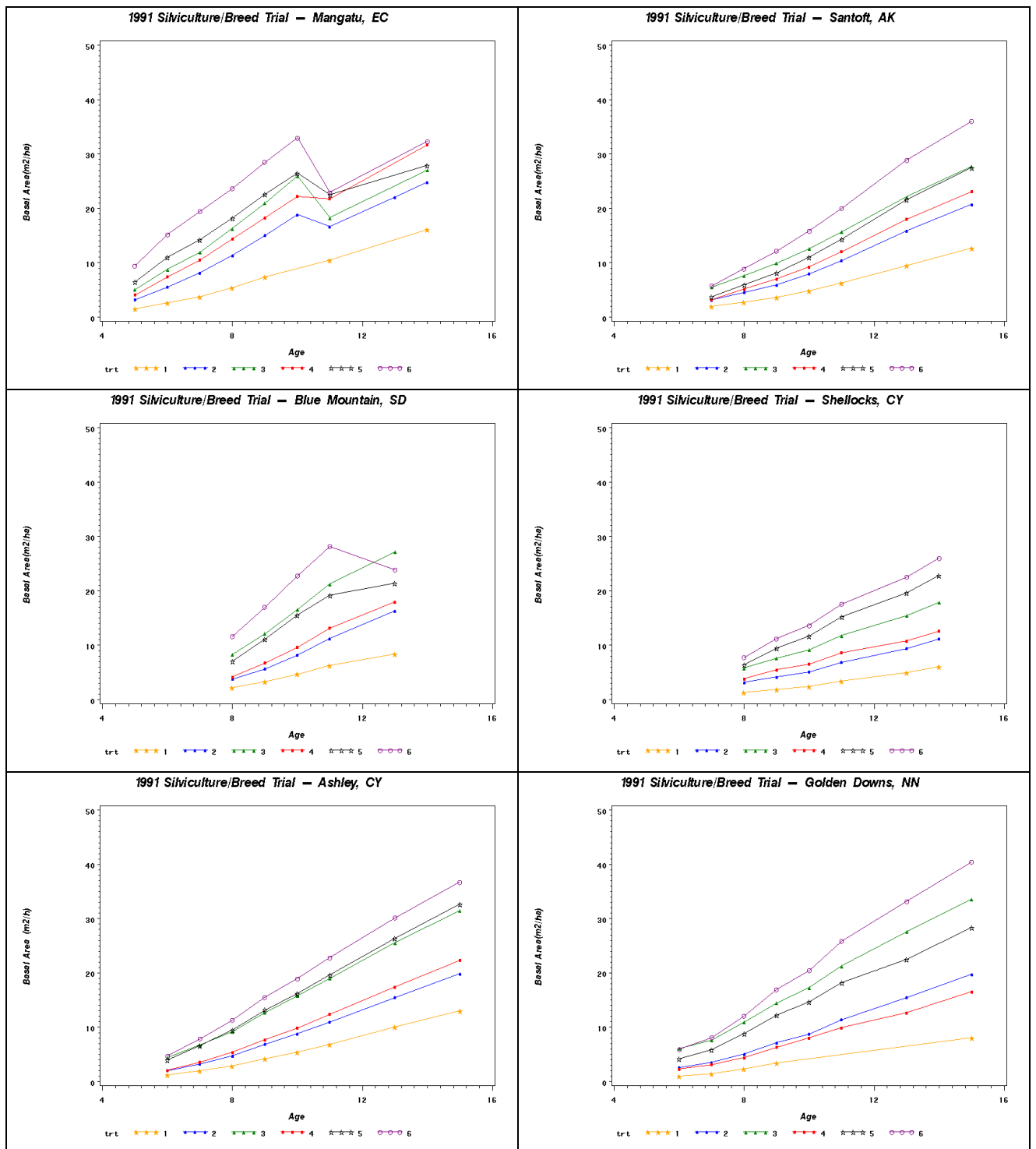


Figure 15. Trends in mean top height with age for each treatment, labelled by site.

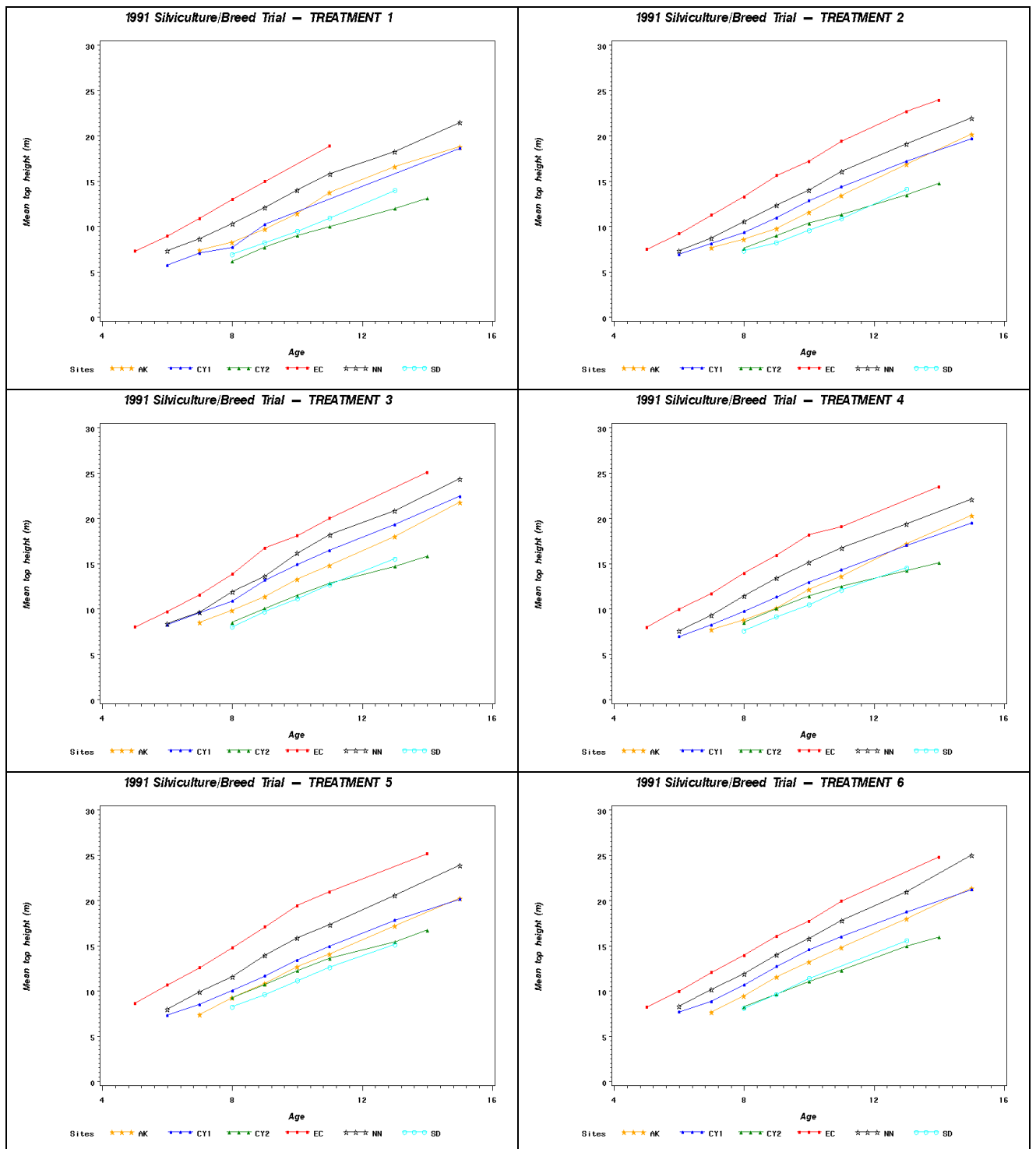


Figure 16. Trends in basal area with age for each treatment, labelled by site.

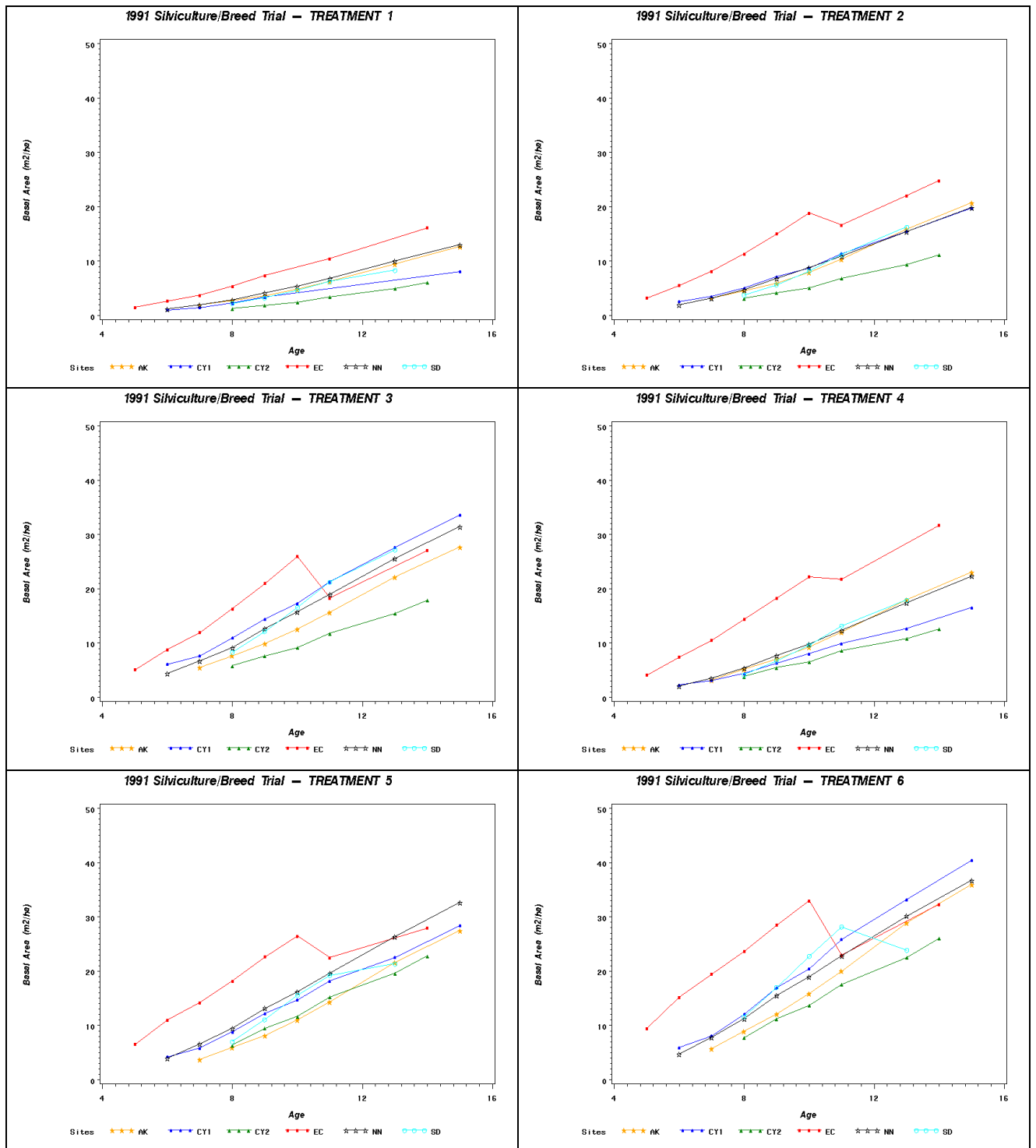


Figure 17. Trends in mean top height with age for each site, labelled by GF rating.
 Treatment 2 data is used exclusively since it is only in treatment 2 that all GF seed lots are present

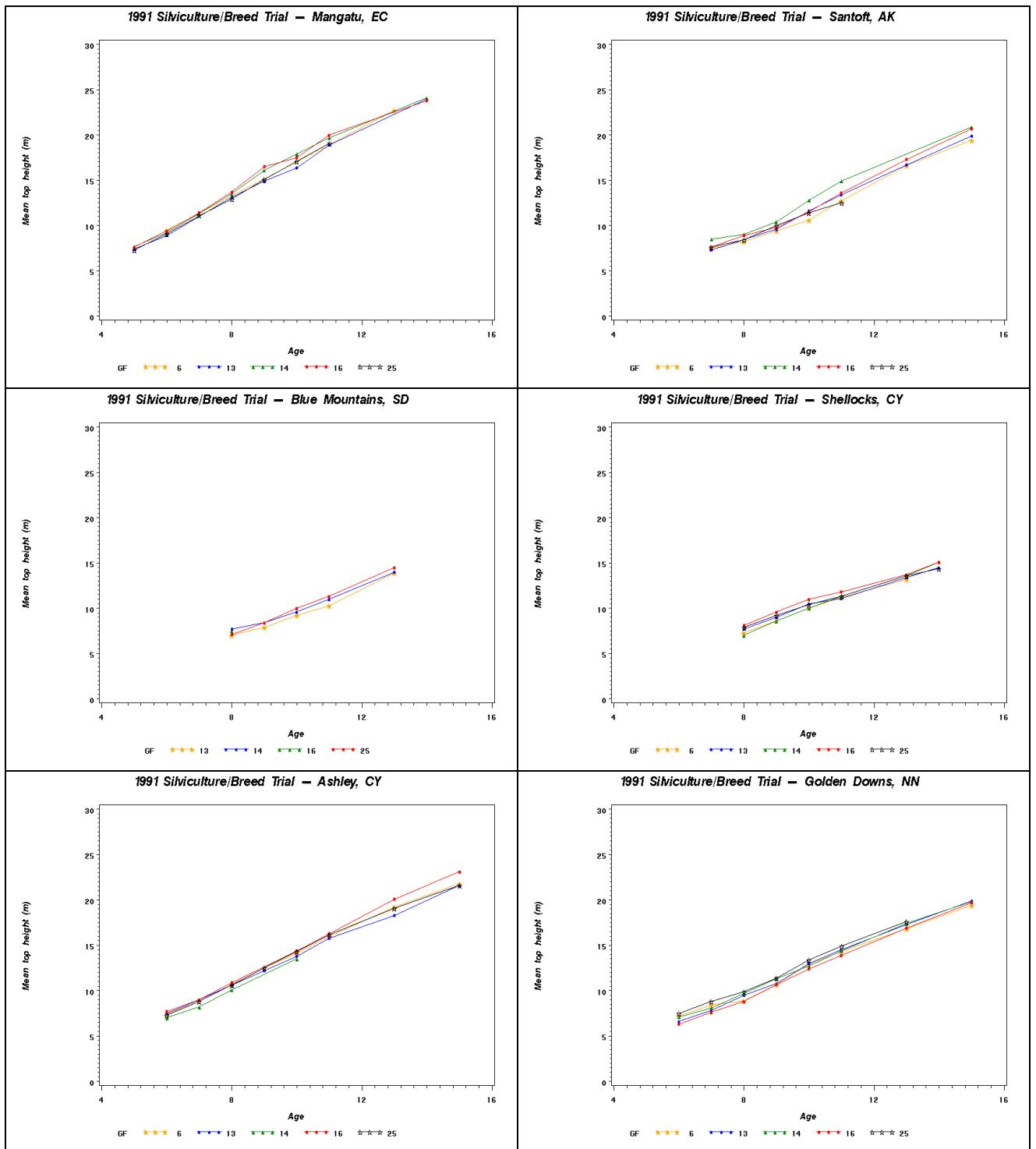


Figure 18. Trends in basal area with age for each site, labelled by GF rating.
 Treatment 2 data is used exclusively since it is only in treatment 2 that all GF seed lots are present

