NWPC INFORMATION NO. 40/20

RESULTS FROM NWPC FIELD TRIALS 1968 TO 1996

Jöran Jermer and Fred G Evans

NORDIC WOOD PRESERVATION COUNCIL

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Frontispiece photos show NWPC field trial sites:
Top: Tåstrup and Vaasa
Middle: Viikki and Simlångsdalen old field
Bottom: Sørkedalen and Simlångsdalen new field

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ABSTRACT

This report gives results from the NWPC field trials started between 1968 and 1996. The tests have been performed in co-operation with the Danish Technological Institute, the Technical Research Centre of Finland, the Norwegian Institute of Wood Technology and the Department of Forest Products (since 2018 Department of Forest Biomaterials and Technology) at the Swedish University of Agricultural Sciences. The field trials were carried out according to the NWPC Standard No. 1.4.2.1./71 "Testing of wood preservatives. Mycological tests. Field test - a field test with stakes" and since 1986 according to prEN 252/EN 252 "Field test method for determining the relative protective effectiveness of a wood preservative in ground contact".

The test fields used are Hillerød and Tåstrup in Denmark, Vaasa, Vihti and Viikki in Finland, Sørkedalen in Norway, Simlångsdalen old and new fields and Ultuna in Sweden. In 1974 all the stakes at Hillerød were moved to Tåstrup, and in 1986 all the stakes at Vaasa and Vihti were moved to Viikki. Between 1992 and 1996 all stakes at Simlångsdalen old field were moved to Simlångsdalen new field. The stakes used in the trials were made from sapwood of Scots pine (*Pinus sylvestris* L.). This is the species on which testing for approval by the Nordic Wood Preservation Council is performed. However, in some of the trials other species were used as well.

The preservatives, their chemical formulations and their average index of decay are presented in tables. The rate of decay is presented in graphs for every product tested.

FOREWORD

Field trials with stakes in ground contact have been conducted for many years in each of the Nordic countries. The main purpose has been to offer wood preservative manufacturers to evaluate their products with the aim to get them accepted with harmonised retentions, since 1980 with Nordic Wood Preservation Council (NWPC) approvals, for use in the Nordic countries. Although focus has been on testing wood preservatives, other materials such as modified wood and different wood species, treated and untreated, have also been tested.

Between 1971 and 1996 the NWPC invited wood preservative manufacturers at several occasions to participate in field trials. However, already in 1968, i.e. one year before the NWPC was founded, the first common Nordic field trial was installed at test sites in Denmark, Finland, Norway and Sweden. Responsible for these trials were the Danish Technological Institute (DTI), the Technical Research Centre of Finland (VTT), the Norwegian Institute of Wood Technology (Treteknisk) and the Royal College of Forestry in Sweden. Since 1978, when the Swedish University of Agricultural Sciences (SLU) was formed, the Swedish partner has been the Department of Forest Products that in 2018 became the Department of Biomaterials and Technology.

As results from field trials may be of great value for scientists involved in studies or research related to wood durability and service life issues, the NWPC in 1986 decided to clarify the conditions for participating in NWPC field trials, see NWPC Information No.15/86. This meant that all test results, as well as formulations of the tested products, would be made public after at least 10 years' testing.

Previous results from NWPC field trials can be found in Henningsson (1974), Borsholt (1979), Bergman and Jermer (1989, 1990 and 1993) and Edlund and Bergman (2000).
The present report is an update of the report published in 2000, including results not earlier published, from trials started in 1990, 1991, 1992, 1993, 1995 and 1996. Raw data from the trials have been provided by Dr Morten Klamer, DTI, Mr Morten Damm, Treteknisk, and Professor Nasko Terziev, SLU, for which they are kindly acknowledged.

Financial support for compiling data and preparation of the report has been provided by the Swedish Wood Preserving Association and the Nordic Wood Preservation Council.

Borgholm and Oslo in November 2020

Jöran Jermer and Fred G Evans

MATERIALS AND METHODS

The field trials were carried out according to the NWPC Standard No. 1.4.2.1/71 "Testing of wood preservatives. Mycological test. Field test - a field test with stakes" and from 1986 according to prEN 252/EN 252 "Field test method for determining the relative protective effectiveness of a wood preservative in ground contact". The stakes used in the trials were made from sapwood of Scots pine (*Pinus sylvestris* L.). This is the species on which testing for Nordic approval is performed, see NWPC Document No. 2 (2010). In previous reports the terms “Baltic redwood” (1979) and “European redwood” (1989, 1990, 1993 and 2000) have been used.

In the 1968 trial European beech (*Fagus sylvatica* L.), European birch (*Betula* spp.) and alder (*Alnus incana* (L.) Moench) were also used. The trial 1980:2 was mainly carried out on European beech. European beech was also used in the 1981 trial. In 1983 a trial was started with untreated and preservative-treated heartwood and sapwood of Scots pine, larch (*Larix sp*), douglas fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), red silver fir (*Abies amabilis*) and western hemlock (*Tsuga heterophylla*). Norway spruce (*Picea abies*) was also used in the 1986 trial and southern pine (*Pinus elliottii/Pinus strobus*) in the trial started in 1991 for one preservative as well as untreated control.

The size of the stakes used in trials until 1985 was 20 x 50 x 500 mm as specified in NWPC Standard No. 1.4.2.1/71 and thereafter 25 x 50 x 500 mm as specified in EN 252.

The locations of the Nordic test fields are shown in Figure 1. The soil types of the test fields are:

Denmark	Hillerød:	Moraine sand
	Tåstrup:	Moraine clay
Finland	Vaasa:	Mull rich soil containing considerable organic material
	Vihti:	Clay containing some organic material
	Viikki:	Clay containing organic material
Norway	Sørkedalen:	Sandy soil containing some organic material
Sweden	Simlångsdalen	
	Old and new field:	Sandy soil
	Ultuna:	Clay

In 1974 the remaining stakes at Hillerød were moved to Tåstrup, in 1986 the remaining stakes at Vaasa and Vihti were moved to Viikki and between 1992 and 1996 remaining stakes at Simlångsdalen old field were moved to Simlångsdalen new field. Swedish trials started from 1992 are installed at Simlångsdalen new field.

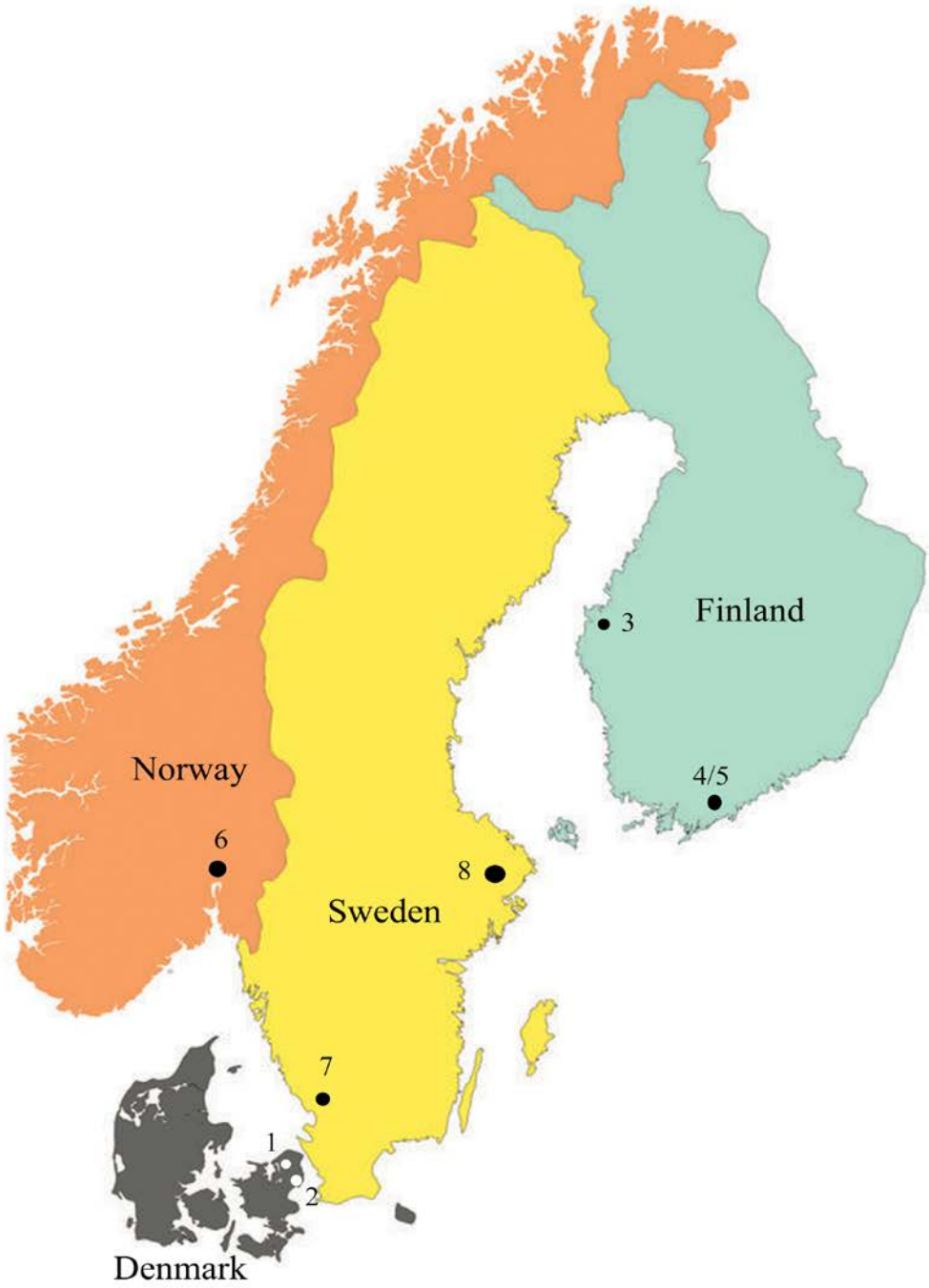

Figure 1. Location of the Nordic test fields.

1. Hillerød	5. Viikki, near Helsinki
2. Tåstrup	6. Sørkedalen
3. Vaasa	7. Simlångsdalen
4. Vihti, near Helsinki	8. Ultuna, near Uppsala

Some historical photos from NWPC fields are shown in Figures 2 to 6.

Figure 2. Simlångsdalen old test field was established in 1943. Since 1992 no NWPC trials have been installed there. The photo was taken during the early 1980s when the site was well maintained and one of the largest field test sites in Europe.

Figure 3. Inspection of EN 252 stakes by Mr Keld H Henriksen at Tåstrup (left) and Mr Fred G Evans at Sørkedalen (right).

Figure 4. Dr Östen Bergman († 2012) and Professor Nasko Terziev at the Ultuna test site in Uppsala used for NWPC trials. The site was closed and moved to another location at the Ultuna campus in 2014.

Figure 5. In addition to stake tests other tests are also often performed at the Nordic test sites. This photo shows demonstration of a decking trial at Sørkedalen by Mr Bjørn Jacobsen (left) for NWPC experts Mr Ingvar Johansson († 2020), Dr Antti Nurmi, Mr Rögnvaldur Gislason and Dr Niels Morsing.

Figure 6. Mr Eero Kangas (middle), former Director of the Finnish Wood Preserving Association, demonstrates L-joint testing at the Viikki test site.

The extent of decay is graded according to the following scale:

Condition	Rating of decay	Index of decay
Sound - no decay	0	0
Slight decay	1	25
Moderate decay	2	50
Severe decay	3	75
Very severe decay (stake rejected, due to failure in a bending apparatus)	4	100

A guideline to inspection and rating of decay is presented in Borsholt and Henriksen (1990). By adding the index of decay for the stakes of each group and dividing the sum by the number of stakes, the average index of decay for each preservative and retention level is obtained. When all stakes in a group have failed (average index of decay = 100), the average life is calculated.

Unless otherwise specified for the trials, the following applies:

- The Swedish University of Agricultural Sciences have been responsible for preparation and treatment of stakes.
- 20 stakes of each retention/other parameter have been installed at the Swedish test site Simlångsdalen and 10 at the other test site(s) selected for the particular trial.
- Each retention level shown for a preservative comprises in principle an average of the retention for all individual stakes treated to that particular retention level.
- Retention, decay index and average service life equal to or greater than 10 are presented without decimal in the tables.
- The ratings of decay are presented in the graphs as graded by the inspector. A grading carried out one year can therefore vary up or down for the following year.

Wood preservatives tested, and their chemical formulations are presented in tables for each trial. In some cases code names have been used for the preservative.

RESULTS

For each trial and each retention of wood preservative the average index of decay after five years' testing as well as after the latest inspection or when the trial was terminated is presented in tables below. The rate of decay is presented in graphs in Appendix for every retention of preservative tested as well as for untreated controls and reference products.

Field Trial 1968

Table 1. NWPC Field trial 1968. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Basilit CFK	$CuSiF_6 \cdot 4H_2O$	35.9	Cu	8.2	Farbenfabriken
	$(NH_4)_2\ Cr_2O_7$	63.1	F	14.7	Bayer AG
	$(NH_4)_2\ HPO_4$	1.0	Cr	26.0	
Boliden K33	CuO	14.8	Cu	11.8	Boliden AB
	CrO_3	26.6	Cr	13.8	
	As_2O_5	34.0	As	22.2	
	H_2O	24.6			
Celcure A	$CuSO_4 \cdot 5H_2O$	23.2	Cu	8.2	Celcure Ltd
	CuO	2.8	Cr	14.0	
	$Na_2Cr_2O_7 \cdot 2H_2O$	40.0	As	14.8	
	As_2O_5	22.7			
	H_2O	11.3			
KP Cuprinol	K-salt 91.3 %				Bönnelyche &
	CuO	15	Cu	10.9	Thuröe AB
	NH_3	18	Na-PCP	6.1	
	CO_2	44			
	H_2O	23			
	P-salt 8.7 %				
	C_6HCl_4ONa (Na-PCP)	70			
	H_2O	30			
Tanalith C	$CuSO_4 \cdot 5H_2O$	35	Cu	8.9	Hickson and
	$As_2O_5 \cdot 2H_2O$	20	As	11.3	Welch Ltd
Wolmanit CB	CuO	10.8	Cu	8.6	Dr Wolman GmbH
	CrO_3	26.4	Cr	13.3	
	H_3BO_3	25.5	B	4.5	
	$KHSO_4$	37.3			
BP Hylosan	PCP	5	PCP	5	Svenska BP AB
	Water repellents	< 4			
	Solvent	ad 100			
Creosote	Scandinavian specification**		Creosote	100	

* Manufacturer of the wood preservatives used for the test.

** Scandinavian specification for creosote (Continental Committee on Creosote Oil Propaganda (1936)):

Composition:	Coal-tar distillate
Density at 38 °C (compared with water at 4 °C):	not less than 1.025, not more than 1.135
Water, per cent by volume:	not more than 1.0
Material insoluble in benzene, per cent by weight:	not more than 0.5
Water extractable phenols, per cent by weight:	not less than 5.0, not more than 9.0
Crystallization temperature:	35 °C
Distillation:	The distillate per cent by weight shall contain within the following limits: up to 210 °C: not more than 4 (inc of water) up to 235 °C: not more than 20 (inc of water)

Table 2. NWPC Field trial 1968. Results after 5 and 43 years' testing.
Wood species: Scots pine

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Hillerød/Tåstrup (Denmark)* Year		
			5	43	$\bar{x}$	5	43	$\bar{x}$
Basilit CFK	1.0	6.7	0	100	16	0	100	17
	1.5	10	3	100	14	3	98	
	2.0	14	0	100	19	0	80	
	3.0	20	0	100	27	0	75	
	4.0	27	0	100	35	0	33	
Boliden K33	1.0	6.6	3	100	15	0	100	19
	1.5	10	0	100	19	0	100	26
	2.0	13**	0	100	22	0	100	34
	3.0	20	0	100	28	0	33	
	4.0	27	0	100	35	0	28	
Celcure A	1.2	7.7	0	100	14	0	100	18
	1.8	12	0	100	16	0	100	22
	2.4	16	0	100	18	0	100	31
	3.6	23	0	100	25	0	38	
	4.8	32	0	100	31	0	25	
KP Cuprinol	1.4	9.0	5	100	14	0	100	16
	2.1	14	0	100	15	0	100	19
	2.7	18	0	100	17	0	100	22
	4.1	27	0	100	18	0	100	29
	5.5	36	0	100	22	0	100	36
Tanalith C	1.2	8.1	0	100	16	0	100	23
(Tancas C)	1.8	12	0	100	19	0	90	
	2.4	16	0	100	26	0	43	
	3.6	24	0	100	31	0	25	
	4.8	33	0	100	37	0	25	
Wolmanit CB	1.5	10	0	100	14	0	100	21
	2.3	15	0	100	18	0	81	
	3.0	20	0	100	24	0	78	
	4.5	31	0	100	30	0	35	
	6.0	41	0	100	35	0	33	
BP Hylosan	17	70	33	100	13	10	100	17
	25	104	9	100	19	0	100	20
	33	126	10	100	21	5	100	23
	50	217	0	100	27	0	95	
	67	305	0	100	32	0	85	
Creosote	17	74	54	100	11	33	100	12
	25	108	54	100	9	18	100	16
	33	143	35	100	14	10	100	18
	50	194	10	100	18	5	100	23
	67	229	3	100	24	0	100	23
Untreated			100		3.5	82	100	5

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1996 and from Hillerød to Tåstrup in 1974.

** This retention corresponds to 9.8 kg/m^3 of NWPC Standard CCA preservative.

Table 3. NWPC Field trial 1968. Results after 5, 45 (Finland) and 5, 51 (Norway) years' testing.
Wood species: Scots pine.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Vaasa/Viikki (Finland)* Year			Sørkedalen (Norway) Year		
			5	45	$\bar{x}$	5	51	$\bar{x}$
Basilit CFK	1.0	6.7	98	100	3.2	33	100	15
	1.5	10	68	100	11	15	100	25
	2.0	14	50	100	22	5	98	
	3.0	20	40	100	27	10	90	
	4.0	27	28	95		0	83	
Boliden K33	1.0	6.6	33	100	17	5	100	26
	1.5	10	18	100	23	10	100	32
	2.0	13**	0	100	32	5	100	35
	3.0	20	0	100	37	0	100	38
	4.0	27	0	90		0	93	
Celcure A	1.2	7.7	40	100	14	5	100	26
	1.8	12	25	100	23	5	100	31
	2.4	16	18	100	27	3	100	35
	3.6	23	10	100	31	0	95	
	4.8	32	0	93		3	98	
KP Cuprinol	1.4	9.0	98	100	4.5	18	100	15
	2.1	14	60	100	8.7	8	100	16
	2.7	18	50	100	11	0	100	22
	4.1	27	10	100	17	5	100	26
	5.5	36	8	100	17	3	100	31
Tanalith C	1.2	8.1	35	100	16	0	100	27
(Tancas C)	1.8	12	22	100	25	5	100	33
	2.4	16	8	100	36	3	100	37
	3.6	24	3	78		0	93	
	4.8	33	0	73		0	85	
Wolmanit CB	1.5	10	100		3.3	13	100	20
	2.3	15	55	100	14	10	100	33
	3.0	20	30	100	33	0	94	
	4.5	31	20	88		5	80	
	6.0	41	0	80		0	78	
BP Hylosan	17	70	5	100	22	25	100	23
	25	104	3	100	23	20	100	30
	33	126	5	100	25	12	100	31
	50	217	0	100	27	10	100	37
	67	305	0	100	28	5	100	35
Creosote	17	74	25	100	17	33	100	20
	25	108	17	100	22	25	100	27
	33	143	13	100	22	20	100	30
	50	194	0	100	24	10	100	34
	67	229	0	100	26	13	100	34
Untreated			100		1	88	100	4.7

*The stakes were moved from Vaasa to Viikki in 1986.
**This retention corresponds to 9.8 kg/m^3 of NWPC Standard CCA preservative.

Table 4. NWPC Field trial 1968. Results after 5 and 36 years' testing in Sweden. Wood species: European beech.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden) Year		
			5	36	$\bar{x}$
Basilit CFK	1.0	6.4	93	100	4.8
	1.5	9.5	83	100	6.4
	2.0	12	55	100	8.5
	3.0	19	34	100	13
	4.0	25	19	100	18
Boliden K33	1.0	6.3	96	100	4.7
	1.5	9.5	94	100	5.2
	2.0	13	74	100	6.3
	3.0	19	55	100	9
	4.0	25	46	100	11
Celcure A	1.2	7.7	99	100	4.3
	1.8	12	99	100	4.4
	2.4	15	91	100	5.3
	3.6	23	78	100	6
	4.8	31	78	100	6
KP Cuprinol	1.4	8.7	95	100	4.6
	2.1	13	74	100	6.3
	2.7	17	55	100	9
	4.1	26	33	100	12
	5.5	36	3	100	15
Tanalith C (Tancas C)	1.2	7.6	94	100	4.8
	1.8	12	90	100	5.5
	2.4	15	71	100	6.5
	3.6	23	48	100	9.4
	4.8	31	34	100	13
Wolmanit CB	1.5	9.6	74	100	6.4
	2.3	14	53	100	10
	3.0	19	31	100	14
	4.5	29	15	100	18
	6.0	39	4	100	23
BP Hylosan	17	59	81	100	5.8
	25	87	63	100	7.5
	33	121	53	100	9.3
	50	181	43	100	11
	67	245	29	100	13
Creosote	17	60	91	100	5.7
	25	90	88	100	5.8
	33	119	73	100	6.4
	50	199	49	100	11
	67	282	30	100	13
Untreated			100		2

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1996.

Table 5. NWPC Field trial 1968. Results after 5 and 42 years' testing in Finland. Wood species: European birch.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Vaasa/Viikki (Finland)* Year		
			5	42	$\bar{x}$
Basilit CFK	1.0	5.9	88	100	5.6
	1.5	8.9	55	100	11
	2.0	12	50	100	17
	3.0	18	33	100	21
	4.0	24	28	100	22
Boliden K33	1.0	6.1	50	100	9.3
	1.5	9.1	53	100	13
	2.0	13	50	100	13
	3.0	18	45	100	16
	4.0	24	30	100	18
Celcure A	1.2	7.1	50	100	6
	1.8	10	50	100	7.3
	2.4	15	53	100	8.3
	3.6	21	28	100	13
	4.8	29	23	100	16
KP Cuprinol	1.4	8.2	78	100	6
	2.1	12	73	100	7.4
	2.7	16	58	100	10
	4.1	25	48	100	14
	5.5	33	40	100	14
Tanalith C	1.2	7.3	53	100	8
(Tancas C)	1.8	11	43	100	12
	2.4	14	40	100	14
	3.6	21	28	100	19
	4.8	30	10	100	23
Wolmanit CB	1.5	8.8	70	100	8
	2.3	13	28	100	18
	3.0	18	23	100	21
	4.5	27	20	100	23
	6.0	36	3	100	26
BP Hylosan	17	66	40	100	12
	25	105	15	100	18
	33	137	5	100	18
	50	208	8	100	23
	67	275	0	100	23
Creosote	17	69	63	100	15
	25	109	50	100	15
	33	147	50	100	16
	50	221	38	100	24
	67	314	13	100	26
Untreated			100		1.5

*The stakes were moved from Vaasa to Viikki in 1986.

Table 6. NWPC Field trial 1968. Results after 5 and 38 years' testing in Norway. Wood species: Alder.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Sørkedalen (Norway) Year		
			5	38	$\bar{x}$
Basilit CFK	1.0	8.0	58	100	9.6
	1.5	12	45	100	13
	2.0	16	33	100	16
	3.0	24	20	100	23
	4.0	32	10	100	25
Boliden K33	1.0	7.8	53	100	8
	1.5	12	40	100	15
	2.0	16	33	100	16
	3.0	24	13	100	21
	4.0	32	8	100	24
Celcure A	1.2	9.4	85	100	5.3
	1.8	14	60	100	6.6
	2.4	19	50	100	9
	3.6	28	28	100	15
	4.8	39	20	100	21
KP Cuprinol	1.4	11	75	100	5.7
	2.1	16	58	100	8.5
	2.7	22	40	100	11
	4.1	33	28	100	15
	5.5	44	18	100	19
Tanalith C (Tancas C)	1.2	9.5	55	100	9
	1.8	14	38	100	14
	2.4	19	30	100	17
	3.6	29	10	100	25
	4.8	39	8	100	28
Wolmanit CB	1.5	12	53	100	12
	2.3	18	40	100	21
	3.0	24	25	100	23
	4.5	36	20	100	27
	6.0	48	10	100	29
BP Hylosan	17	91	43	100	9
	25	140	33	100	19
	33	187	28	100	22
	50	281	15	100	28
	67	377	15	100	29
Creosote	17	94	65	100	7.2
	25	143	43	100	11
	33	198	38	100	17
	50	315	18	100	27
	67	428	3	100	29
Untreated			100		2.8

Field trial 1971

10 stakes were installed at each field for each retention level, whereas 20 untreated stakes were installed at each field.

Table 7. NWPC Field trial 1971. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Boliden APUS	CuO	12.3	Cu	9.8	Boliden AB
	CrO_3	32.4	Cr	16.8	
	As_2O_5	27.4	As	17.9	
	Na_2O	3.4			
	H_2O	24.5			
Boliden P50	CuO	15.0	Cu	12.0	Boliden AB
	CrO_3	21.0	Cr	10.9	
	P_2O_5	17.6	P	7.7	
	H_2O	46.4			
Celcure M	$CuSO_4 \cdot 5H_2O$	36.0	Cu	9.2	Rentokil Ltd
	$Na_2Cr_2O_7 \cdot 2H_2O$	40.0	Cr	14.8	
	$Cr(CH_3COO)_3 \cdot H_2O$	4.0	B	3.5	
	H_3BO_3	20.0			
Celcure SM	$CuSO_4 \cdot 5H_2O$	53.0	Cu	13.5	Rentokil Ltd
	$Na_2Cr_2O_7 \cdot 2H_2O$	29.4	Cr	10.8	
	$Cr(CH_3COO)_3\ H_2O$	2.9	B	2.6	
	H_3BO_3	14.7			
Cuprinol Tryck (KP-N)	CuO	12	Cu	9.5	Hager AB
	$C_7H_{15}COOH$	4.75	$C_7H_{15}COOH$	4.75	
	NH_3	≈ 20			
	CO_2	≈ 40			
	H_2O	≈ 25			
KP Cuprinol	K-salt 91.3 %		Cu	10.9	Bönnelyche & Thuröe AB
	CuO	15	Na-PCP	6.1	
	NH_3	18			
	CO_2	44			
	H_2O	23			
	P-salt 8.7 %				
	C_6HCl_4ONa (Na-PCP)	70			
	H_2O	30			
Kemira K64	CuO	22.9	Cu	18.3	Kemira Oy
	CrO_3	33.6	Cr	17.5	
	As_2O_5	18.3	As	11.9	
	P_2O_5	10.4	P	4.5	
	SO_3	3.6			
	H_2O	11.2			
Kemira C64	CuO	25.3	Cu	20.2	Kemira Oy
	CrO_3	40.8	Cr	21.2	
	P_2O_5	16.8	P	7.3	
	SO_3	4.4			
	H_2O	12.7			
Tanalith NCA (Tancas NCA)	$CuSO_4$	29.7	Cu	11.8	Hickson and Welch Ltd
	$Na_2Cr_2O_7$	31.7	Cr	12.6	
	$As_2O_5 \cdot 2H_2O$	26.3	As	20.0	
	$Na_4As_2O_7$	12.3			

Table 7. (cont'd) NWPC

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Wolmanit CBS	CuO	10.8	Cu	8.6	Dr Wolman GmbH
	CrO_3	26.4	Cr	13.7	
	H_3BO_3	25.5	B	4.5	
	$KHSO_4$	35.7			
	ZnO	1.6			
BP SUN/WP (CBY)	Mixture of saturated and unsaturated hydrocarbons				The British Petroleum Co Ltd
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	-
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test

Table 8. NWPC Field trial 1971. Results after 5, 43 (Sweden) and 42 (Finland) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Vaasa/Viikki (Finland)* Year		
			5	43	$\bar{x}$	5	42	$\bar{x}$
Celcure M	1.4	9.9	0	100	18	53	100	8.8
	2.2	16	0	100	24	38	100	19
	3.0	20	0	100	30	28	93	
	4.5	33	0	100	35	0	73	
	6.0	42	0	100	39	5	63	
Celcure SM	1.0	7.3	0	100	14	53	100	7.2
	1.5	11	0	100	15	68	100	8
	2.0	15	0	100	16	45	100	15
	3.0	21	0	100	25	30	98	
	4.0	29	0	100	31	8	93	
KP Cuprinol	1.5	11	0	100	13	40	100	7
	2.3	16	0	100	13	48	100	10
	3.3	25	0	100	14	28	100	14
	4.3	30	0	100	21	15	100	18
	5.7	41	0	100	20	15	100	20
Kemira K64	0.8	5.5	3	100	15	13	100	15
	1.2	8.1	0	100	21	25	100	19
	1.6	11	0	100	26	3	100	26
	2.4	18	0	100	27	0	90	
	3.2	23	0	100	34	0	73	
Kemira C64	0.9	6.6	0	100	19	23	100	10
	1.4	10	0	100	24	15	100	19
	1.8	12	0	100	30	5	90	
	2.7	19	0	100	34	3	88	
	3.7	26	0	100	34	0	75	
Tanalith NCA	1.0	7.4	0	100	14	8	100	14
	1.5	11	0	100	18	10	100	17
	2.0	14	0	100	20	3	100	25
	3.0	21	0	100	26	0	93	
	4.0	30	0	100	26	0	90	
NWPC Standard Preservative No 1	1.3	9.4	0	100	24	8	100	18
Untreated			100		3.7	100		1

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1993 and from Vaasa to Viikki in 1986.

Table 9. NWPC Field trial 1971. Results after 5, 43 (Sweden) and 48 (Norway) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
			5	43	$\bar{x}$	5	48	$\bar{x}$
Boliden APUS	1.0	7.2	0	100	16	0	100	25
	1.5	11	0	100	20	0	100	32
	2.0	14	0	100	22	0	100	35
	3.0	21	0	100	35	0	90	
	4.0	29	0	100	32	0	93	
Boliden P50	1.0	7.2	0	100	14	3	100	20
	1.5	11	0	100	18	0	100	25
	2.0	14	0	100	19	0	100	30
	3.0	22	0	100	27	0	100	34
	4.0	29	0	100	32	0	100	34
Cuprinol Tryck	1.6	11	3	100	13	13	100	17
(KP-N)	2.4	17	0	100	15	3	100	23
	3.2	23	0	100	15	0	100	24
	4.8	34	0	100	19	0	100	25
	6.4	45	0	100	23	0	100	27
Wolmanit CBS	1.3	8.7	0	100	19	0	100	23
	1.9	14	0	100	23	0	100	33
	2.5	18	0	100	26	0	95	
	3.8	27	0	100	31	0	93	
	5.0	37	0	100	36	0	88	
BP SUN/WP		75	40	100	9	8	100	18
(CBY)		112	25	100	11	3	100	20
		150	33	100	12	0	100	26
		225	18	100	16	0	100	31
		300	13	100	18	0	95	
NWPC Standard Preservative No 1	1.3	9.6	0	100	24	3	100	31
Untreated			100		3.7	100		4.2

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1993.

Field trial 1973-74

Concerning the reference stakes treated with NWPC Standard Preservative No. 1 it was found that an erroneous concentration had been used in the treatment. Thus no results from stakes treated with NWPC Standard Preservative No. 1 are presented and results of the NWPC reference in the field trials of 1971 or 1975 may be used for comparison instead. Stakes were installed in 1973 in Sweden, Finland and Norway, whereas stakes for the Danish site were installed in 1974.

Table 10. NWPC Field trial 1973-74. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Amline	CuO	7.4	Cu	5.9	Hager AB
	CrO_3	4.0	Cr	2.1	
	As_2O_5	4.0	As	2.6	
	NH_3	19.0			
	CO_2	39.0			
	H_2O	26.4			
Boliden P50 B	CuO	11.2	Cu	8.9	Boliden AB
	CrO_3	15.8	Cr	8.2	
	P_2O_5	13.2	P	5.8	
	B_2O_3	14.1	B	4.4	
	H_2O	45.7			
Celcure AP5	CuO	13.1	Cu	10.5	Boliden AB
	CrO_3	34.4	Cr	17.9	
	As_2O_5	27.5	As	17.9	
	H_2O	25.0			
Kemira KC-73	CuO	25.5	Cu	23.5	Kemira Oy
	$CuSO_4$	8.3	Cr	34.4	
	CrO_3	66.2			
Kemira KCA-73	CuO	21.6	Cu	19.3	Kemira Oy
	$CuSO_4$	5.4	Cr	28.0	
	CrO_3	53.8	As	12.5	
	As_2O_5	19.2			
Kemira KFN-73	$Cu(NH_4)_4CO_3$	13.5	Cu	4.3	Kemira Oy
	NH_4HCO_3	9.9	Cr	7.5	
	BON-NH_4**	4.8	F	7.9	
	NH_4OH	2.6	BON-NH_4	3.9	
	NH_4F	15.3			
	$(NH_4)_2CrO_4$	22.1			
	NaOH	0.9			
	H_2O	add 100			
Hylosan PT (Permapruf T)	TBTO	10	TBTO	10	Penarth Research Centre
	Benzalkyl trimethyl ammoniumchloride (BAC)	40	BAC	40	
	Additives	≈ 6			
	H_2O	add 100			

* Manufacturer that originally ordered the test.

** BON = Beta-oxy naphthoic acid.

Table 11. NWPC Field trial 1973-74. Results after 5, 39 (Sweden) and 28 (Denmark) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Tåstrup (Denmark) Year		
			5	39	$\bar{x}$	5	28	$\bar{x}$
Boliden P50 B	1.3	8.4	33	100	12	18	92	
	1.8	12	16	100	16	13	53	
	2.5	17	0	100	18	3	40	
	3.5	24	0	100	26	3	31	
	5.0	34	3	100	27	3	33	
Kemira KCA-73	0.5	3.7	1	100	16	5	53	
	0.8	5.2	1	100	20	5	48	
	1.1	7.4	0	100	24	3	28	
	1.5	10	0	100	29	0	30	
	2.1	15	0	95		8	28	
Untreated 1**			93	100	4.4	95	100	3.8
Untreated 2**			100	100	3.0	-	-	-

*The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1993.
**For Simlångsdalen Untreated 1 applies to the old field and Untreated 2 to the new field.

Table 12. NWPC Field trial 1973-74. Results after 5, 39 (Sweden) and 40 (Finland) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Vaasa/Viikki (Finland)* Year		
			5	39	$\bar{x}$	5	40	$\bar{x}$
Amline	2.1	14	16	100	10	43	100	12
	3.0	20	4	100	13	25	100	17
	4.3	29	4	100	17	10	100	16
	6.0	41	0	100	25	15	100	20
	8.5	59	0	100	25	20	100	25
Celcure AP5	1.0	6.2	0	100	16	25	100	17
	1.4	9.0	0	100	21	10	100	18
	2.0	13	0	100	23	3	100	27
	2.8	19	0	98		3	88	
	4.0	28	0	93		0	78	
Hylosan PT	1.0	6.8	18	100	10	25	100	14
(Permapruf T)	1.5	10	8	100	13	18	100	17
	2.0	14	10	100	17	5	100	18
	3.0	16	8	100	19	5	100	19
	4.0	23	4	100	20	0	100	22
Untreated			93	100	4.4	100		1

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1993 and from Vaasa to Viikki in 1986.

Table 13. NWPC Field trial 1973-74. Results after 5, 39 (Sweden) and 46 (Norway) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
			5	39	$\bar{x}$	5	46	$\bar{x}$
Kemira KC-73	0.5	3.6	20	100	13	8	100	24
	0.8	5.2	15	100	16	0	100	28
	1.1	7.4	3	100	25	0	100	33
	1.5	10	0	91		0	95	
	2.1	15	0	95		0	90	
Kemira KFN-73	1.9	12	0	100	11	20	100	17
	2.6	18	0	100	14	10	100	21
	3.7	25	0	100	16	18	100	21
	5.2	29	24	100	12	18	100	24
	7.4	42	16	100	14	10	100	28
Untreated			93	100	4.4	93	100	4.8

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1993.

Field trial 1975

Table 14. NWPC Field trial 1975. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Basilit KM	$CuSO_4 \cdot 5H_2O$	49.5	Cu	12.6	Desowag-Bayer
	CrO_3	1.7	Cr	17.8	Holzschutz GmbH
	$K_2Cr_2O_7$	47.8			
	Anticorrosive	1.0			
Gufa 521	CuO	13.8	Cu	11.1	Gullviks Fabriks AB
	H_3BO_3	4.0	B	0.7	
	C_2H_5COOH	5.1			
	NH_3, CO_2 H_2O	rest**			
Kemira K-75	Copper thallate (9.5 % Cu)	43.1	Cu	5.7	Kemira Oy
	Copper naphthenate (9.5 % Cu)	16.9			
	CH_2Cl_2	40.0			
Kemira KB-75	$Cu(NH_4)_4CO_3$	30.2	Cu	9.8	Kemira Oy
	CH_3COONH_4	5.0	B	4.8	
	$(NH_4)_2B_4O_7$	24.0			
	NH_4HCO_3	40.0			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	-
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.
** Not specified in detail.

Table 15. NWPC Field trial 1975. Results after 5, 36 (Sweden) and 25 (Denmark) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Tåstrup (Denmark) Year		
			5	36	$\bar{x}$	5	25	$\bar{x}$
Basilit KM	1.5	10	1	100	18	13	30	
	2.3	16	0	100	21	10	18	
	3.0	21	0	95		5	3	
	4.5	32	0	76		0	0	
	6.0	42	0	80		0	0	
Gufa 521	1.5	10	0	100	11	18	100	17
	2.3	15	0	100	12	25	95	
	3.0	20	0	100	13	5	86	
	4.5	30	1	100	18	5	40	
	6.0	41	0	98		10	36	
Kemira K-75		16	0	100	11	10	93	
		25	0	100	17	0	75	
		32	0	100	19	5	45	
		45	0	100	24	0	35	
		58	0	100	28	0	30	
Kemira KB-75	1.5	9.5	0	100	11	40	100	14
	2.3	14	0	100	12	8	80	
	3.0	19	0	100	13	13	78	
	4.5	30	0	100	16	5	40	
	6.0	40	0	100	27	3	28	
NWPC Standard Preservative No 1	1.3	8.9	0	100	21	0	35	
Untreated			100		3.8	100		3.6

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1994.

Field trial 1977-78

Two test sites were originally used in Finland, Vaasa and Vihti, near Helsinki. The stakes for Vihti were installed in 1978. The test sites in Vaasa and at Vihti were closed in 1986 and all stakes moved to a new test site, Viikki, also in the vicinity of Helsinki.

Table 16. NWPC Field trial 1977-78. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Basilit CCB	$CuSO_4 \cdot 5H_2O$	34	Cu	8.7	Desowag-Bayer
	$K_2Cr_2O_7$	39	Cr	14.3	Holzschutz GmbH
	CrO_3	1	B	4.5	
	H_3BO_3	26			
Boliden P50**	CuO	15.0	Cu	12.0	Rentokil Ltd
	CrO_3	21.0	Cr	10.9	
	P_2O_5	17.6	P	7.7	
	H_2O	46.4			
Cuprinol Tryck**	CuO	12	Cu	9.5	Hager AB
(KP-N)	$C_7H_{15}COOH$	4.75	$C_7H_{15}COOH$	4.75	
	NH_3	≈ 20			
	CO_2	≈ 40			
	H_2O	≈ 25			
NWPC Standard	CuO	19.0	Cu	15.2	
Preservative No 1	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.

** Preservative introduced by the NWPC in the test.

Table 17. NWPC Field trial 1977-78. Results after 5, 33 (Sweden) and 35-36 (Finland) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Vaasa/Viikki (Finland)* Year			Vihti/Viikki (Finland)* Year		
			5	33	$\bar{x}$	5	36	$\bar{x}$	5	35	$\bar{x}$
Basilit CCB	1.0	7.0	55	100	6.5	75	100	9	43	100	12
	2.0	14	35	100	14	43	100	13	25	98	
	3.0	21	18	100	19	20	73		33	89	
	4.0	28	15	100	25	5	70		10	72	
	5.0	34	13	100	29	5	50		5	61	
Boliden P50	1.0	6.9	63	100	6.6	28	100	12	45	100	10
	2.0	14	30	100	15	33	100	17	35	100	17
	3.0	21	15	100	18	30	98		25	100	21
	4.0	28	15	100	24	5	95		10	94	
	5.0	34	15	100	27	5	90		23	82	
Cuprinol Tryck	1.5	9.8	53	100	6	90	100	5.8	50	100	10
(KP-N)	2.5	17	40	100	10	35	100	14	28	100	13
	3.5	23	5	100	20	33	100	16	45	100	12
	4.5	30	15	100	20	53	100	16	18	100	22
	6.5	44	10	100	26	40	100	16	20	98	
NWPC Standard	0.4	2.6	50	100	7	58	100	12	25	100	12
Preservative No 1	0.8	5.1	18	100	14	35	100	17	20	100	14
	1.1	7.8	13	100	23	25	98		5	100	23
	1.5	10	8	100	23	20	100	24	13	97	
Untreated			95	100	3.8	100		2.3	100		2

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1993 and from Vaasa and Vihti to Viikki in 1986

Field trial 1978

Table 18. NWPC Field trial 1978. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Hylosan PT** (Permapruf T)	TBTO	10	TBTO	10	Penarth Research Centre
	Benzalkyl trimethyl ammoniumchloride (BAC)	40	BAC	40	
	Additives	≈ 6			
	H_2O	≈ 44			
Cuprinol Tryck**	CuO	12	Cu	9.5	Hager AB
	$C_7H_{15}COOH$	4.75	$C_7H_{15}COOH$	4.75	
	NH_3	≈ 20			
	CO_2	≈ 40			
	H_2O	≈ 25			
Xylamon DV	PCP (technical grade)	6.2	PCP	6.2	Desowag-Bayer
	Dichlofluanid	0.5	Dichlofluanid	0.5	Holzschutz GmbH
	Resin	9.0			
	Paraffin wax	2.0			
	Petroleum oil (distillation range 180-215°C)	82.3			
Ammoniacal Cu Test product B	Cu_2O	10.78	Cu	9.5	Cuprinol Ltd
	NH_4HCO_3	50.00			
	Acid 810***	4.98			
	NH_3	34.24			
Ammoniacal Cu Test product C	Cu_2O	7.16	Cu	6.3	Cuprinol Ltd
	NH_4HCO_3	33.21			
	Acid 810***	26.57			
	NH_3	33.06			
Celcure Q	Dialkyl dimethyl quaternary ammonium compound (DDQA) (general formula R_2Me_2NCl, where R is an alkyl radical of C_8 or C_{10} chain lengths)	50	DDQA	50	Rentokil Ltd
	H_2O	50			
Celcure T	Alkyl dimethyl tertiary amine hydrochloride (ADTA) (general formula RMe_2NHCl where R is a mixed alkyl radical of C_{12}, C_{14} and C_{16} chain lengths)	50	ADTA	50	Rentokil Ltd
	H_2O	50			
Creosote	Scandinavian specification				-**
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	-
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.
** Preservative introduced by the NWPC in the test.
*** A mixture of isomers of C8, C9 and C10 saturated aliphatic monocarboxylic acids.

Table 19. NWPC Field trial 1978. Results after 5, 27 (Sweden) and 30 (Norway) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
			5	27	$\bar{x}$	5	30	$\bar{x}$
Hylosan PT	1.0	6.2	38	100	7.8	30	100	15
(Permapruf T)	1.5	9.1	32	100	9.8	20	100	17
	2.0	12	22	100	17	15	100	20
	3.0	20	13	100	21	5	100	24
	4.0	27	13	100	22	3	100	25
Cuprinol Tryck	1.8	12	42	100	7.5	10	100	18
	2.5	17	32	100	10	5	100	20
	3.5	23	8	100	15	3	100	21
	5.0	34	23	100	13	8	100	24
	7.0	48	10	100	21	0	100	26
Xylamon DV	3.1	3.4	45	100	7.3	20	100	18
	4.4	4.8	27	100	11	3	100	21
	6.2	6.7	17	100	14	10	100	21
Ammoniacal Cu	1.6	10	74	100	5	8	100	18
Test product B	2.4	15	40	100	7.7	5	100	21
	3.2	20	25	100	11	5	100	21
	4.8	30	33	100	13	5	100	25
	6.4	41	20	100	15	3	100	26
Ammoniacal Cu	2.4	15	42	100	7.2	13	100	17
Test product C	3.2	21	25	100	11	8	100	21
	4.8	31	23	100	10	3	100	21
	6.4	42	13	100	16	5	100	25
	9.6	64	8	100	23	3	100	26
Celcure Q	0.7	4.4	97	100	3	53	100	10
	1.0	6.2	100		3.5	48	100	10
	1.4	8.9	100		4	45	100	13
	2.0	13	53	100	7.8	43	100	15
	2.8	18	43	100	9.3	30	100	17
Celcure T	0.7	4.3	97	100	2.8	60	100	8
	1.0	6.1	100		3	58	100	9.3
	1.4	8.8	100		3	48	100	13
	2.0	12	92	100	4.5	45	100	13
	2.8	18	89	100	5	45	100	17
Creosote		125	50	100	7	5	100	18
NWPC Standard Preservative No 1	1.3	9.0	5	100	23	0	100	28
Untreated			100		2.6	68	100	7.2

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1992.

The poor results for Celcure Q and Celcure T were explained by a misunderstanding related to retentions specified by the manufacturer. It was thus agreed to carry out a new test with higher retentions, see Field trial 1980:3.

Field trials 1980

The field trial commencing 1980 consists of three different experiments viz. 1980:1, 1980:2 and 1980:3. The preservatives tested are summarized in Table 20.

Table 20. NWPC Field trials 1980. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Mitrol Test product	$Cu(NH_3)_4^{2+}$	16.6	Cu	8.0	KenoGard AB
	Benzalkoniumchloride (QKKBCI)	20.6	QKKBCI	20.6	
	NH_3	9.3			
	$(NH_4)_2CO_3$	3.7			
	Anti foam agent	0.2			
	H_2O	add 100			
BP Hylosan CP	Cu	6.6	Cu	6.6	Svenska BP AB
	Propionate	42.0			
	NH_3	12.9			
	Ca	0.9			
	H_2O	add 100			
Synprolam 35 DMA	Acetate salt of dimethyl tertiary fatty amine (Synprolam 35DM) (combination of C_{13} and C_{15} species is approx ratio 70:30; overall ratio of linear:branched chains is approx 50:50)	100	35DMA	100	ICI Ltd
Synprolam 35DMBQC	Benzylchloride quaternary salt of dimethyl tertiary fatty amine (Synprolam 35DM) (combination of C_{13} and C_{15} species is approx ratio 70:30; overall ratio of linear:branched chains is approx 50:50)	50	35DMBQC	50	ICI Ltd
	H_2O	50			
Amline special	CuO	4.2	Cu	3.4	Hager AB
	As_2O_5	2.25	As	1.5	
	CrO_3	2.25	Cr	1.2	
	NH_3	20.1			
	CO_2	45.5			
	H_2O	25.7			
Celcure Q	Dialkyl dimethyl quaternary ammonium compound (DDQA) (general formula R_2Me_2NCl, where R is an alkyl radical of C_8 or C_{10} chain lengths)	50	DDQA	50	Rentokil Ltd
	H_2O	50			
Celcure T	Alkyl dimethyl tertiary amine hydrochloride (ADTA) (general formula RMe_2NHCl where R is a mixed alkyl radical of C_{12}, C_{14} and C_{16} chain lengths)	50	ADTA	50	Rentokil Ltd
	H_2O	50			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	-
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test

Field trial 1980:1

Table 21. NWPC Field trial 1980:1. Results after 5, 27 (Sweden) and 31 (Denmark) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Tåstrup (Denmark) Year		
			5	27	$\bar{x}$	5	31	$\bar{x}$
Mitrol Test product	0.94	6.2	85	100	4.3	50	100	8.3
	1.9	12	60	100	10	8	100	14
	3.8	25	15	100	20	3	98	
	5.6	37	5	100	21	0	100	28
	7.5	49	18	100	23	0	80	
BP Hylosan CP	2.0	13	78	100	5	20	100	13
	2.7	18	54	100	9.7	0	100	16
	3.8	26	38	100	13	0	100	25
	5.3	36	28	100	14	5	95	
	7.4	50	30	100	19	0	75	
Synprolam 35 DMA in water	0.16	1.0	100		1	100		2.2
	0.31	2.0	100		1.5	100		2.5
	0.62	4.1	100		1.7	100		2.7
	1.25	8.2	100		2.8	100	100	3.4
	2.50	16	81	100	5.7	95	100	4
Synprolam 35 DMA in white spirit	0.20	0.8	100		2.3	100		3
	0.40	1.6	100		2.4	100		3.7
	0.80	3.1	100		2.7	98	100	3.7
	1.60	6.1	88	100	4.2	92	100	4.7
	3.20	13	74	100	5.8	93	100	5
Synprolam 35 DMBQC in water	0.16	1.0	100		1.5	100		2
	0.31	2.1	100		2	100		2.5
	0.62	4.0	100		2	100		2.6
	1.25	7.9	78	100	5.4	95	100	3.5
	2.50	16	36	100	13	80	100	6
NWPC Standard Preservative No 1	1.3	8.8	4	100	22	0	42	
Untreated			100		1.4	100		2.5

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1995.

Field trial 1980:2

In this trial, European beech (*Fagus sylvatica* L.) was the main species used, with Scots pine (*Pinus sylvestris* L.) included for comparison (Table 22). Three retention levels of Amline special (Table 20) were applied for European beech and one level for Scots pine. For every retention level of European beech the treated stakes were stored in plastic bags for 0, 2, 4 and 8 weeks. Stakes of Scots pine were stored in plastic bags 0 and 8 weeks. The aim of storing the stakes in plastic bags immediately after treatment was to find out if this could affect distribution and fixation of the preservative and thus increase the efficacy.

Table 22. NWPC Field trial 1980:2. Results after 5, 27 (Sweden) and 36 (Norway) years' testing.

Wood preservative		Concentration of Cu % m/m	Retention of Cu kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
				5	27	$\bar{x}$	5	36	$\bar{x}$
Amline special - European beech									
Weeks in plastic bag	0	0.2	1.2	100		3.8	29	100	11
	2	0.2	1.2	100		3.5	31	100	10
	4	0.2	1.2	100		3.3	33	100	11
	8	0.2	1.2	100		3.7	33	100	10
Weeks in plastic bag	0	0.4	2.5	94	100	4.6	29	100	14
	2	0.4	2.5	96	100	4.5	27	100	12
	4	0.4	2.5	87	100	5	31	100	13
	8	0.4	2.6	85	100	4.7	27	100	11
Weeks in plastic bag	0	0.8	5.2	65	100	6	17	100	17
	2	0.8	5.1	75	100	6	15	100	18
	4	0.8	5.1	83	100	5.8	17	100	15
	8	0.8	5.1	79	100	5.5	21	100	16
Amline special - Scots pine									
Weeks in plastic bag	0	0.4	2.8	8	100	22	0	100	25
	8	0.4	2.8	4	100	23	0	100	25
NWPC Standard Preservative No 1									
European beech		1.3[1)]	8.1[2)]	77	100	5.6	23	100	14
Scots pine		1.3[1)]	9.1[2)]	10	100	26	2	100	25

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1993.
[1)] Concentration of all components of the preservative.
[2)] Retention of all components of the preservative.

Field trial 1980:3

Table 23. NWPC Field trial 1980:3. Results after 5, 11 (Sweden) and 20 (Norway) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden) Year			Sørkedalen (Norway) Year		
			5	11	$\bar{x}$	5	20	$\bar{x}$
Celcure Q	2.6	16	67	100	5.7	28	100	13
	3.6	22	38	100	6.7	18	100	16
	4.6	28	38	100	8	8	100	18
Celcure T	2.6	17	100		3.4	43	100	12
	3.6	22	97	100	4.3	38	100	13
	4.6	28	84	100	5	25	100	14

Field trial 1981

Table 24. NWPC Field trial 1981. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
HW 81	$Cu(CH_3COO)_2 \cdot H_2O$	70.3	Cu	22.38	Hager AB
	$Zn(CH_3COO)_2 \cdot 2H_2O$	23.4	Zn	6.98	
	H_3BO_3	6.3	B	1.10	
Hager Aceta (HCZ 81)	$Cu(CH_3COO)_2 \cdot H_2O$	73.0	Cu	23.2	Hager AB
	$Zn(CH_3COO)_2 \cdot 2H_2O$	22.9	Zn	6.8	
	H_3BO_3	4.1	B	0.7	
HZ 81	$Zn(CH_3COO)_2 \cdot 2H_2O$	85.1	Zn	27.9	Hager AB
	$ZnSO_4 \cdot 7H_2O$	11.1			
	H_3BO_3	3.8	B	0.66	
Hylosan PT 1/81	Benzalkyl trimethyl ammoniumchloride** (BAC)	40	BAC	40	KenoGard AB
	TBTO	10	TBTO	10	
	Amine D810	2			
	NH_3	2.25			
	Anti foam agent	2			
	H_2O	add 100			
ES 240	A mixture of monoalkyl trimethyl ammonium chloride (MTAC) and dialkyl dimethyl ammonium chloride (DDAC)	50	MTAC/ DDAC	50	Akzo Chemie Nederland bv
	H_2O	30			
	Isopropanol	20			
Arquad AC	Monoalkyl trimethyl ammonium chloride (MTAC)	19.2	MATC	19.2	Akzo Chemie Nederland bv and Gori as
	H_2O	80.8			
Arquad IC	Monoalkyl trimethyl ammonium chloride (MTAC)	17.3	MTAC	17.3	Gori as
	Imazalil sulphate (IS)	1.9	IS	1.9	
	H_2O	80.8			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	-
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.

** Gloquat C

Table 25. NWPC Field trial 1981. Results after 5, 26 (Sweden) and 30 (Denmark) years' testing.

Wood preservative	Concentration % m/m		Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Tåstrup (Denmark) Year		
				5	26	$\bar{x}$	5	30	$\bar{x}$
European beech									
HW 81									
Weeks in plastic bag	6	1.0	6.2	45	100	7	53	100	8
	6	2.0	12	21	100	12	28	100	20
	6	3.0	19	15	100	15	8	100	21
	6	4.0	25	3	100	16	3	100	23
Weeks in plastic bag	0	2.0	12	28	100	11	18	100	16
Scots pine									
Hager Aceta (HCZ 81)		0.7	4.6	39	100	9	8	100	14
		0.9	5.8	34	100	11	5	100	23
		1.3	8.5	13	100	18	0	100	26
		1.8	12	3	100	23	0	84	
		2.6	18	0	100	25	0	60	
HZ 81		1.1	7.3	89	100	4.6	90	100	4.4
		1.6	11	79	100	5.4	95	100	4.4
		2.2	14	78	100	5.5	73	100	5.1
		3.1	21	36	100	6.4	53	100	6.5
		4.4	30	19	100	7.8	45	100	6.7
Hylosan PT 1/81		1.0	6.4	11	100	11	40	100	7.2
		1.5	9.5	1	100	15	28	100	8.8
		2.0	13	6	100	18	25	100	12
		3.0	20	3	100	20	25	100	15
		4.0	26	1	100	21	23	100	24
ES 240		1.0	6.3	100		3.6	95	100	4
		1.4	8.9	75	100	6.3	78	100	5
		1.9	12	39	100	9.3	80	100	5
		2.7	18	28	100	14	55	100	6.6
		3.8	25	25	100	15	50	100	7.7
Arquad AC		2.5	15	95	100	3.2	95	100	4.2
		3.5	22	100		3.8	95	100	4.6
		5.0	31	96	100	4.8	75	100	5.5
		7.0	46	69	100	6.6	68	100	6.6
		9.9	65	43	100	10	58	100	7.7
Arquad IC		2.5	16	98	100	3.5	95	100	4.2
		3.5	23	90	100	4.8	98	100	4.6
		5.0	33	74	100	6	83	100	5.5
		7.0	45	48	100	9.7	60	100	6.5
		9.9	64	25	100	13	58	100	7.2
NWPC Standard Preservative No 1		1.3	8.7	6	100	23	5	72	
Untreated Scots pine				100		1	100		3
Untreated European beech				100		1.4	100		1

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1992.

Field trial 1982

Table 26. NWPC Field trial 1982. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
H 82-alfa	$CuAc_2 \cdot H_2O$	27.0	Cu	8.6	Hager AB
	$ZnAc_2 \cdot 2H_2O$	59.4	Zn	17.7	
	CrO_3	13.5	Cr	7.0	
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.

Table 27. NWPC Field trial 1982. results after 5, 25 (Sweden) and 31 (Finland) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life($\bar{x}$) Simlångsdalen (Sweden)* Year			Viikki (Finland) Year		
			5	25	$\bar{x}$	5	31	$\bar{x}$
H 82-alfa	1.2	8.4	23	100	10	12	100	12
	1.7	12	31	100	13	20	100	15
	2.4	17	18	100	17	3	100	18
	3.4	24	15	100	18	0	98	
	4.8	34	11	100	20	0	85	
NWPC Standard Preservative No 1	1.3	9.0	20	100	19	0	93	
Untreated			-	-	-	98	100	3.7

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1992.

Field trial 1982-83

The purpose of this trial was to test the performance of sapwood and heartwood of different wood species, untreated and treated with two types of preservative, a CCA-type and a copper-based type. Thus, sapwood and heartwood of Scots pine (*Pinus sylvestris* L.), Larch (*Larix sp*), Douglas fir (*Pseudotsuga menziesii*), Lodgepole pine (*Pinus contorta*), Red silver fir (*Abies amabilis*) and Western hemlock (*Tsuga heterophylla*) were included in the trial. Untreated heartwood of Lodgepole pine, Douglas fir, Scots pine and Larch were not exposed at Tåstrup.

For every retention level of preservatives tested, 10 stakes were set out at Ultuna near Uppsala and 10 stakes at Tåstrup. The stakes were not completely free from knots and the quality not as high as in the other trials.

Table 28. NWPC Field trial 1982-83. Preservatives tested with different wood species and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m	
Rentokil K33	CuO	14.8	Cu	11.8
	CrO_3	26.6	Cr	13.8
	As_2O_5	34.0	As	22.2
	H_2O	24.6		
Cuprinol Tryck	CuO	12.0	Cu	9.5
	$C_7H_{15}COOH$	4.75	$C_7H_{15}COOH$	4.75
	NH_3	≈ 20		
	CO_2	≈ 40		
	H_2O	≈ 25		

Tabell 29. NWPC Field trial 1982-83. Results after 5, 20 (Sweden) and 21 (Denmark) years' testing.

Wood preservative/wood species	Retention kg/m^3	Index of decay and average life($\bar{x}$) Ultuna (Sweden) Year 5	20	$\bar{x}$	Tåstrup (Denmark) Year 5	21*	$\bar{x}$
CUPRINOL TRYCK							
Red silver fir, sapwood	6.3	50	100	7	35	100	13
	23	5	100	12	0	43	
	35	0	100	16	0	30	
Red silver fir, heartwood	23	0	100	14	0	45	
Lodgepole pine, sapwood	7.4	93	100	5	20	100	7
	23	18	100	12	3	75	
	38	3	100	15	0	47	
Lodgepole pine, heartwood	16	13	100	9.5	0	65	
Douglas fir sapwood	6.5	85	100	5.3	5	94	
	20	3	100	14	0	25	
	32	0	100	17	0	25	
Douglas fir, heartwood	11	100	100	3.3	3	83	
Larch, sapwood	6.9	43	100	7.8	2.5	100	13
	22	8	100	17	0	53	
	36	3	100	21	0	43	
Larch, heartwood	5.5	95	100	3.2	0	100	13
Scots pine, sapwood	6.8	60	100	6.4	20	100	9
	22	10	100	12	0	55	
	36	10	100	17	0	25	
Scots pine, heartwood	15	35	100	7.4	2.5	64	
Western hemlock, sapwood	6.1	68	100	5.8	30	100	9.2
	21	15	100	12	0	48	
	33	3	98	-	0	45	
Western hemlock, heartwood	21	3	100	13	0	58	
RENTOKIL K33							
Red silver fir, sapwood	3.6	40	100	6.3	30	100	12
	12	40	100	7.3	3	20	
	22	8	100	10	0	3	
Red silver fir, heartwood	12	38	100	7.5	3	18	
Lodgepole pine, sapwood	4.0	100		4	20	100	8
	13	50	100	6.4	0	25	
	22	5	100	9.3	0	0	
Lodgepole pine, heartwood	9.1	68	100	6	0	47	
Douglas fir sapwood	3.5	93	100	5	23	100	11
	12	55	100	8	0	30	
	19	13	100	11	0	0	
Douglas fir, heartwood	9.4	73	100	4.4	0	0	
Larch, sapwood	3.8	78	100	5.4	25	100	11
	13	33	100	8.3	0	22	
	21	25	100	8.4	0	0	
Larch, heartwood	3.2	95	100	3	0	85	

Table 29 (cont'd)

Wood preservative/wood species	Retention kg/m³	Index of decay and average life($\bar{x}$) Ultuna (Sweden) Year 5	20	$\bar{x}$	Tåstrup (Denmark) Year 5	21*	$\bar{x}$
Scots pine, sapwood	3.6	60	100	6	13	100	10
	13**	8	100	8.7	0	25	
	20	3	100	8.6	0	0	
Scots pine, heartwood	11	43	100	7.8	0	28	
Western hemlock, sapwood	3.5	58	100	5.8	20	98	
	12	40	100	7.3	0	10	
	21	13	100	9	0	0	
Western hemlock, heartwood	11	18	100	12	5	30	
UNTREATED							
Red silver fir, sapwood		100		2.6	100		2.6
hertwood		100		2.4	100		2.2
Lodgepole pine, sapwood		100		1.9	100		2
Lodgepole pine, heartwood		100		1.8	–	–	
Douglas fir, sapwood		100		2.6	100		3.6
Douglas fir, heartwood		100		2.1	–	–	
Scots pine, sapwood		100		2.4	100		4
Scots pine, heartwood		90	100	3.2	–	–	
Larch, sapwood		100		2	100		2.8
Larch, heartwood		100		2.4	–	–	
Western hemlock, sapwood		100		3	100		2.3
Western hemlock, heartwood		100		4	100		4.2

* In Denmark untreated and treated stakes of Red silver fir and Western Hemlock were installed in 1983. All other Danish stakes were installed in 1982. However, all stakes have been inspected after 21 years. All Swedish stakes were installed in 1983.

**This retention corresponds to 9.8 kg/m³ of NWPC Standard CCA preservative.

Field trial 1983

Table 30. NWPC Field trial 1983. Preservative tested and the chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
BP Hylosan CP	Cu	6,6	Cu	6.6	Svenska BP AB
	Propionate	42.0			
	NH_3	12.9			
	Ca	0.9			
	H_2O	add 100			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.

Table 31. NWPC Field trial 1983. Results after 5 and 24 years' testing in Sweden

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year		
			5	24	$\bar{x}$
BP Hylosan CP	2	14	61	100	12
	2.7	18	39	100	16
	3.8	26	20	100	17
	5.3	36	6	100	21
	7.4	51	0	100	23
NWPC Standard Preservative No 1	1.3	8.7	3	100	19

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1992.

Field trial 1984

Table 32. NWPC Field trial 1984. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Kempol 100	Cu as polyacrylate	3.7	Cu	3.7	Kemira Oy
	NH_3	6.0			
	H_2O	add 100			
Kempol 101	Cu as polyacrylate -methylmetacrylate	2.4	Cu	2.4	Kemira Oy
	NH_3	3.8			
	H_2O	add 100			
Kempol 110	Cu as polyacrylate	2.8	Cu	2.8	Kemira Oy
	Didecyldimethylammonium chloride (DDAC)	4.3	DDAC	4.3	
	NH_3	4.5			
	Nonylphenylpolyglycol ether	12.8			
	Isopropanol	1.7			
	H_2O	add 100			
Kempol 200	Zn as polyacrylate	3.8	Zn	3.8	Kemira Oy
	NH_3	5.9			
	H_2O	add 100			
KS-impregneringsmedel	Cu	9.4	Cu	9.4	Kemira Oy
	NH_3HCO_3	30.9			
	NH_3	10.6			
	H_2O	add 100			
Celcure A oxide	CuO	10	Cu	8	Rentokil Svenska AB
	CrO_3	27	Cr	14	
	As_2O_5	23	As	15	
	H_2O	40			
Mitrol CeQure	CuO	12.5	Cu	10.0	Keno Gard VT
	Octyldecyldimethyl-ammonium chloride (AAC1)	25.0	AAC1	25.0	
	NH_4HCO_3	24.9			
	NH_3	11.8			
	H_2O	25.3			

* Manufacturer that originally ordered the test.

Table 32. (cont'd)

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Mitrol CeQure 1125	CuO	10.0	Cu	8.0	Keno Gard VT
	Octyldecyldimethyl-ammonium chloride (AAC1)	20.0	AAC1	20.0	
	ZnO	10.2	Zn	8.2	
	NH_4HCO_3	20.0			
	NH_3	18.8			
	H_2O	20.5			
Mitrol CeQure 3125	CuO	12.5	Cu	10.0	Keno Gard VT
	Octyldecyldimethyl-ammonium chloride (AAC1)	12.5	AAC1	12.5	
	N-alkyldimethylbenzyl-ammonium chloride (AAC2)	12.5	AAC2	12.5	
	NH_4HCO_3	24.9			
	NH_3	11.8			
	H_2O	25.3			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.

Table 33. NWPC Field trial 1984. Results after 5, 30 (Sweden) and 35 (Norway) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
			5	30	$\bar{x}$	5	35	$\bar{x}$
Kempol 100	4.5	32	100		1	3	100	12
	6.3	45	96	100	1.5	0	100	14
	8.9	64	83	100	4	0	100	17
	13	91	48	100	10	0	100	18
	18	130	13	100	14	0	100	19
Kempol 101	7.1	50	88	100	4.2	0	100	14
	10	70	69	100	7	0	100	16
	14	99	49	100	11	0	100	17
	20	142	25	100	14	0	100	20
	28	194	11	100	15	0	100	21
Kempol 110	5.9	40	58	100	7.5	0	100	14
	8.3	55	24	100	12	0	100	17
	12	72	11	100	14	0	100	17
	17	104	1	100	16	0	100	20
	24	153	0	100	19	0	100	23
Kempol 200	6.6	47	100	100	1.5	28	100	8
	9.3	67	100	100	2	30	100	7.3
	13	96	100	100	2.3	33	100	8
	19	136	100	100	2.4	20	100	8
	26	191	100	100	3	13	100	8.2
KS-impregneringsmedel	1.8	13	83	100	4.4	0	100	16
	2.5	18	76	100	6.6	0	100	18
	3.5	25	70	100	7.3	0	100	18
	5.0	36	35	100	12	0	100	20
	7.1	51	5	100	19	0	100	49
Celcure A oxide	1.3	9.0	41	100	11	0	100	18
	1.8	13	26	100	17	0	100	22
	2.5	18	10	100	20	0	85	
	3.5	26	3	95		0	85	
	5	37	1	95		0	67	
Mitrol CeQure	1.3	9.1	81	100	5.4	0	100	17
	1.8	13	45	100	10	0	100	18
	2.7	19	35	100	12	0	100	17
	3.7	26	8	100	14	0	100	19
	5.2	37	1	100	15	0	100	22

Table 33. (cont'd)

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
			5	30	$\bar{x}$	5	35	$\bar{x}$
Mitrol CeQure 1125	1.7	12	44	100	8	0	100	16
	2.3	16	20	100	11	0	100	17
	3.3	23	1	100	14	0	100	18
	4.7	34	1	100	16	0	100	21
	6.5	47	0	100	18	0	98	
Mitrol CeQure 3125	1.3	9.1	91	100	5	0	100	12
	1.8	13	46	100	8.6	0	100	16
	2.7	19	26	100	12	0	100	18
	3.7	25	13	100	13	0	100	19
	5.2	35	0	100	15	0	100	22
NWPC Standard Preservative No 1	1.3	9.3	5	100	18	0	100	24
Untreated			100		1	45	100	6

The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1992.

Field trial 1985

Table 34. NWPC Field trial 1985. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Kemira KCP	CuO	14.8	Cu	11.8	Kemira Oy
	CrO_3	26.6	Cr	13.8	
	P_2O_5	21.0	P	9.2	
	H_2O	37.6			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.

Table 35 NWPC Field trial 1985. Results after 5, 29 (Sweden) and 26 (Denmark) years' testing

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life($\bar{x}$) Simlångsdalen (Sweden)* Year			Tåstrup (Denmark) Year		
			5	29	$\bar{x}$	5	26	$\bar{x}$
Kemira KCP	1	7.1	21	100	11	15	90	
	1.4	10	9	100	15	5	83	
	2	14	6	100	16	0	50	
	2.8	20	1	100	21	0	15	
	4	29	0	100	24	0	18	
NWPC Standard Preservative No 1	1.3	9.4	0	100	18	3	38	

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1992.
** The test was terminated in Denmark after 26 years.

Field trial 1986

The main purpose of this trial was to compare untreated and CCA-treated sapwood of Scots pine with untreated and CCA-treated sapwood and heartwood of Norway spruce. The new stake size (25 x 50 x 500 mm) according to the proposed European standard, later becoming EN 252, was introduced as well as two concentrations of the reference preservative.

Table 36. NWPC Field trial 1986. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Tanalith CCA oxide B	CuO	14.8	Cu	11.8	Hickson Timber
	CrO_3	26.6	Cr	13.8	Products
	As_2O_5	34.0	As	22.2	
	H_2O	24.6			
NWPC Standard	CuO	19.0	Cu	15.2	
Preservative No 1	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

*Manufacturer of the preservative. However, the test was ordered by Jotun A/S and the stakes were treated by The Norwegian Institute of Wood Technology

Table 37. NWPC Field trial 1986. Results after 5, 26 (Sweden) and 33 (Norway) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m³	Index of decay and average life($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
			5	26	$\bar{x}$	5	33	$\bar{x}$
PINE SAPWOOD								
Tanalith CCA oxide B	1.4	8.1	23	100	13	5	100	21
	2	11	6	100	18	3	100	22
	2.8	16	3	85		0	100	27
NWPC Standard	0.3	2.0	65	100	5.4	8	100	16
Preservative No. 1	1.3	8.3	5	93		0	78	
Untreated			100		1.5	80	100	5.7
SPRUCE SAPWOOD								
Tanalith CCA oxide B	1.4	3.1	28	100	7.8	10	100	12
	2	5.0	16	100	9	3	100	14
	2.8	6.9	8	100	12	3	100	16
Untreated			100		1.7	38	100	8.1
SPRUCE HEARTWOOD								
Tanalith CCA oxide B	1.4	2.8	33	100	7.5	13	100	12
	2	3.2	14	100	10	0	100	14
	2.8	4.7	9	100	11	0	100	14
Untreated			100		2.8	38	100	9.5

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1992.

Field trial 1987

Table 38. NWPC Field trial 1987. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
HK 17/1 **	Modified lignin	10	Lignin	10	Holmens Bruk AB
	$CuSO_4$	25	Cu	10	
KLS + 1.5M Cu***	Modified lignin + $CuSO_4$	6.0			Holmens Bruk AB
NWPC Standard	CuO	19.0	Cu	15.2	
Preservative No 1	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	

* Manufacturer that originally ordered the test.
** Two step process
*** One step process

Table 39. NWPC Field trial 1987. Results after 5, 24 (Sweden) and 26 (Finland) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life($\bar{x}$) Simlångsdalen (Sweden)* Year			Viikki (Finland) Year		
			5	24	$\bar{x}$	5	26	$\bar{x}$
HK 17/1	1.4 + 1.15	10 + 7.9	14	100	17	35	100	16
Modif. Lignin + $CuSO_4$	2.1 + 1.3	15 + 8.8	9	100	18	33	100	15
	3.0 + 1.5	19 + 10	8	100	19	35	100	15
	4.2 + 1.8	28 + 12	1	100	19	35	100	15
	6.0 + 2.2	36 + 14	3	100	21	20	100	18
KLS + 1.5M Cu	1.3	8.9	69	100	5.6	85	100	6
Modif. Lignin - $CuSO_4$	1.8	11	61	100	6.8	65	100	9
	2.5	15	43	100	8.7	63	100	8
	3.6	17	36	100	8.3	48	100	11
	5.0	18	40	100	9.0	40	100	8.2
NWPC Standard	1.3	8.9	8	78		3	73	
Preservative No 1	0.3	2.1	61	100	6	50	100	11
Untreated			98	100	3	98	100	2.8

* The stakes were moved from Simlångsdalen ols field to Simlångsdalen new field in 1993.

Field trial 1988

Table 40. NWPC Field trial 1988. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Cuprinol Tryck 86	Coppertetraammindi-hydrogencarbonate	38.0-44.0	Cu	9.5	Kemira Oy
	Bensalkoniumchloride	4.8	BAC	4.8	
	H_2O	add 100			
Wolmanit CX Test product F	Bis-(N-cyclohexyl-diazenium-dioxy) copper (Cu-HDO)	12.5	Cu-HDO	12.5	Dr Wolman GmbH
	H_3BO_3	6.25	B	1.1	
	H_2O and additives	ad 100			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	
EN 252 CCA Reference	$CuSO_4 \cdot 5H_2O$	35.0	Cu	9.0	
	$K_2Cr_2O_7$	45.0	Cr	16.0	
	$As_2O_5 \cdot 2H_2O$	20.0	As	11.0	

* Manufacturer that originally ordered the test.

Table 41. NWPC Field trial 1988. Results after 5, 30 (Sweden) and 25 (Finland) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life($\bar{x}$) Simlångsdalen (Sweden)* Year			Viikki (Finland) Year		
			5	30	$\bar{x}$	5	25	$\bar{x}$
Cuprinol Tryck 86	2.5	18	61	100	9	10	98	
	3.5	25	44	100	13	25	95	
	5.0	36	11	100	23	10	95	
	7.0	51	5	100	25	13	68	
	10	72	3	100	27	8	55	
Wolmanit CX	0.8	5.7	100	100	4	74	100	6.7
Test product F	1.5	11	71	100	6.4	58	100	8.3
	2.3	16	66	100	7	54	100	9.6
	3.1	21	53	100	9	50	100	12
	4.6	31	49	100	10	53	100	14
	6.2	42	51	100	11	51	100	16
	9.2	61	38	100	15	46	91	
NWPC Standard	0.3	1.9	93	100	4.7	63	100	10
Preservative No 1	1.3	8.6	14	100	24	23	85	
EN 252 CCA Reference	0.3	2.0	94	100	4	65	100	9
	1.5	10	15	100	24	20	45	
Untreated			100		2	100		4

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1994.

Field trial 1989

Table 42. NWPC Field trial 1989. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Impregneringsolja K	Creosote WEI type B**	90	Creosote	90	Svenska Träimpreg-nerings AB Suecia
	Aromatic hydrocarbons	10			
Creosote	WEI type B#	100	Creosote	100	Svenska Träimpreg-nerings AB Suecia
Cu-Cr-Zn-F Test product	$(NH_4)_2Cr_2O_7$	63.0	Cr	26.0	Desowag-Bayer
	$CuSiF_6$	17.3	Cu	4.0	Holzschutz GmbH
	$ZnSiF_6$	19.7	Zn	4.1	
			F	14.2	
Tanalith 3418	$Cu_3 (BO_3)_2$	13.8	Cu	8.5	Hickson Timber
	NH_3	8.57	B	2.9	Products Ltd
	H_2O	77.63			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	
EN 252 CCA Reference	$CuSO_4 \cdot 5H_2O$	35	Cu	9	
	$K_2Cr_2O_7$	45	Cr	16	
	$As_2O_5 \cdot 2H_2O$	20	As	11	

* Treater/Manufacturer that originally ordered the test.

**Impregneringsolja K specification:

Density, g/cm^3:	1.00-1.15	
Crystallization temperature, °C:	maximum 25	
Distillation, % v/v:	up to 210 °C	0
	up to 235 °C	maximum 30
	up to 280 °C	0
	up to 300 °C	40-70
	up to 355 °C	80-95

#WEI Type B specification:

Density 20/4 °C, g/cm^3:	1.02-1.15	
Water, % v/v:	maximum 1	
Crystallization temperature, °C:	maximum 23	
Acid constituents, % v/v:	maximum 3	
Insuluble matter (drop test):	traces	
Distillation, % v/v:	up to 235 °C	maximum 20
	up to 300 °C	40-60
	up to 355 °C	70-90

Table 43. NWPC Field trial 1989. Results after 5 and 30 years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Tåstrup (Denmark) Year		
			5	30	$\bar{x}$	5	30	$\bar{x}$
Impregneringsolja K		142	8	100	14	18	100	14
Creosote WEI type B		134	0	100	16	10	98	
Cu-Cr-Zn-F Test product	0.4	2.9	100		2	100	100	4
	0.6	4.3	100		2.5	68	100	7
	0.8	5.8	95	100	3.8	43	100	8
	1.1	7.9	76	100	6	18	98	
	1.6	12	45	100	10	0	83	
Tanalith 3418	3.7	27	41	100	9	5	100	17
	5.1	37	34	100	11	20	100	20
	8.8	64	9	100	17	0	88	
	12	91	0	100	21	13	80	
	16	116	3	100	25	0	64	
NWPC Standard Preservative No 1	0.3	2.1	74	100	5.4	40	100	9
	1.3	9.3	23	100	22	3	55	
EN 252 CCA Reference	0.3	2.2	99	100	3.2	80	100	6
	1.5	11	16	100	22	5	55	
Untreated			100		1.4	No data available		

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1995.

Field trial 1990

Table 44. NWPC Field trial 1990. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Celcure O oxid	CuO	14.4	Cu	11.5	Rentokil Svenska AB
	CrO_3	35.7	Cr	18.6	
	H_2O	49.9			
Celcure M(P)/CB(P)	CuO	9.5	Cu	10.0	Rentokil Svenska AB
	$CuSO_4 \cdot 5H_2O$	7.6	Cr	14.0	
	CrO_3	27.0	B	4.3	
	H_3BO_3	24.3			
	H_2O	31.6			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	
EN 252 CCA Reference	$CuSO_4 \cdot 5H_2O$	35.0	Cu	9.0	
	$K_2Cr_2O_7$	45.0	Cr	16.0	
	$As_2O_5 \cdot 2H_2O$	20.0	As	11.0	

* Manufacturer that originally ordered the test.

Table 45. NWPC Field trial 1990. Results after 5 and 29 years' testing in Sweden and Norway. Swedish trial terminated.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
			5	29	$\bar{x}$	5	29	$\bar{x}$
Celcure O oxid	1.3	9.7	15	100	24	33	85	
	1.8	13	4	90		25	60	
	2.6	19	3	73#		25	53	
	3.7	26	0	68#		23	50	
	5.2	38	0	61#		33	48	
Celcure M(P)/CB(P)	1.5	11	23	100	21	45	89	
	2.1	15	6	85#		30	78	
	3.0	22	4	78#		25	58	
	4.2	32	0	63#		25	48	
	6.0	45	0	59#		25	50	
NWPC Standard	0.3	2.2	75	100	5.4	25	100	13
Preservative No 1	1.3	9.5	5	100	23	0	78	
EN 252 CCA Reference	0.3	2.2	98	100	3.2	25	100	12
	1.5	11	9	100	24	0	90	
Untreated			100		1.4	60	100	7.2

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1995.
# Trial terminated after 28 years.

Field trial 1991

Table 46. NWPC Field trial 1991. Preservatives tested and their chemical formulation.

Wood preservative/ treatment	Chemical formulation	% m/m	Active components	% m/m	Manufacturer*
Dual copper dithiocarbamate Test product	DCD Copper Complex Aquatreat SDM	50** 50	Cu Sodium dimethyl dithiocarbamate (SDDC)	10 40	ISK Biotech Corp.
Chlorothalonil Test product	Chlorothalonil Heavy aromatic oil	5 95	Chlorothalonil	5	ISK Biotech Corp.
Propiconazole Test product	Propiconazole Cationic emulsifier Solvent H_2O	5.0 25.0 10.0 60.0	Propiconazole	5.0	Janssen Pharmaceutica
Wolmanit CX Test product	$CuCO_3Cu(OH)_2$ Cu-HDO[#] H_3BO_3 Additives H_2O	8.1 6.1 4.0 47.5 34.3	Cu Cu-HDO B	4.6 6.1 0.7	Dr Wolman GmbH
Basilit ZKF type B	CuO ZnO CrO_3 $(NH_4)_2SiF_6$	2.3 2.4 23.1 10.3	Cu Zn Cr F	1.8 1.9 12.0 6.6	Desowag Material-Schutz GmbH
ACQ 2100	CuO Bardac 22 NH_3 (as carrier) H_2O	9.4 4.7 9.4 add 100	Cu Bardac 22	7.5 4.7	CSI/Laporte
AMCQ 2100	CuO Bardac 22 Amine (as carrier) H_2O	10.9 5.5 42.00 add 100	Cu Bardac 22	8.7 5.5	CSI/Laporte
ACBQ 1100	CuO Benzalkoniumchloride (BAC) NH_3 (as carrier) H_2O	7.9 7.9 7.9 add 100	Cu BAC	6.3 7.9	CSI/Laporte
AMCBQ 1100	CuO BAC Ammonim pentaborate Amine (as carrier)	9.0 9.0 5.0 34.5	Cu BAC	7.2 9.0	CSI/Laporte
Tanalith 3436	$CuCO_3Cu(OH)_2$ H_3BO_3 Tebuconazole	13.6 21.9 0.33	Cu B Tebuconazole	7.8 3.8 0.33	Hickson Timber Products Ltd
Kreosot MTN 90	Creosote	100[#]	Creosote	100	Tarconord A/S
Acetylated wood	Acetic acid anhydride	100	Acetic acid anhydr	100	Chalmers University of Technology

Table 46. (cont'd)

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
NWPC Standard	CuO	19.0	Cu	15.2	-
Preservative No 1	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	
EN 252 CCA Ref	$CuSO_4 \cdot 5H2O$	35.0	Cu	9.0	-
	$K_2Cr_2O_7$	45.0	Cr	16.0	
	$As_2O_5 \cdot 2H_2O$	20.0	As	11.0	

* Manufacturer that originally ordered the test, or at the time when the test was started, produced the preservative.
** The formulation tested deviated by mistake from the intended. The concentration of SDDC was somewhat too high.
# Bis-(N-cyclohexyldiazeniumdioxy)-copper.

Kreosot MTN 90 specification:

Density 20/4 °C, g/cm^3:	1.07-1.15	
Water, % v/v:	maximum 0.5	
Crystallization temperature, °C:	maximum 40	
Acid constituents, % v/v:	maximum 0.2	
Benz(a)pyrene, ppm	maximum 200	
Napththalene, % v/v:	maximum 1.0	
Insoluble matter (drop test):	traces	
Distillation, % v/v:	up to 235 °C	0
	up to 300 °C	35-40
	up to 355 °C	85-95

Table 47. NWPC Field trial 1991. Results after 5, 28 (Sweden) and 22 (Finland) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Viikki (Finland) Year		
			5	28	$\bar{x}$	5	22	$\bar{x}$
Dual copper	1.25	8.3/8.3**	85	100	5.5	8	100	13
dithiocarbamate	1.75	11.4/11.5	73	100	7	0	83	
Test product	2.5	16.4/16.3	73	100	8	10	85	
	3.5	22.1/23.2	50	100	11	8	58	
	5.0	30.4/32.8	48	100	12	10	60	
Chlorothalonil	6.0	30	44	100	10	45	100	9.2
Test product	12.0	60	20	100	20	33	98	
	24.0	122	0	75		5	75	
	36.0	186	1	66		13	48	
	48.0	258	0	73		5	45	
Propiconazole	2.0	13	83	100	5	70	100	6.4
Test product	4.0	24	38	100	8.3	58	100	9.3
	6.0	37	19	100	14	53	100	10
	8.0	49	14	100	19	48	100	11
	10.0	62	3	100	20	25	100	13
Wolmanit CX	0.5	3.3	100		2.8	78	100	6.6
Test product	1.0	6.6	91	100	4.6	48	100	12
	1.5	10	58	100	6.6	25	100	11
	2.0	13	29	100	11	33	100	16
	3.0	20	20	100	17	15	90	
Basilit ZKF type B	1.0	6.6	100		2	73	100	6.8
	1.5	10	94	100	3.8	70	100	6.6
	2.0	13	75	100	6	33	100	12
	2.5	17	45	100	9.3	20	88	
	3.0	20	31	100	13	15	70	
ACQ 2100	2.4	16	73	100	5.2	10	100	13
Scots pine	4.7	31	24	100	16	5	98	
	7.6	50	0	100	24	0	58	
	11.3	75	0	93		5	50	
	15.1	100	0	75		0	53	
ACQ 2100	2.4	14	63	100	6.7	-	-	
Southern pine	4.7	29	13	100	19	-	-	
	7.6	45	3	100	21	-	-	
	11.3	68	0	98		-	-	
	15.1	92	0	100	25	-	-	
AMCQ 2100	1.8	12	51	100	11	18	100	14
	4.1	27	23	100	17	23	98	
	6.5	42	8	95		0	67	
	9.8	63	1	88		3	78	
	13.0	84	3	76		0	65	

** Specified as retention of the two main active ingredients: Copper complex/Aquatreat SDM.

Table 47. (cont'd)

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Viikki (Finland) Year		
			5	28	$\bar{x}$	5	22	$\bar{x}$
ACBQ 1100	2.1	14	83	100	5.5	45	100	11
	4.2	27	55	100	12	15	98	
	6.8	44	6	98		0	85	
	10.1	66	0	75		3	60	
	13.8	88	0	68		0	55	
AMCBQ 1100	1.9	12	58	100	7.7	33	100	14
	3.7	24	31	100	14	0	100	19
	5.9	39	21	100	18	8	75	
	8.9	59	6	95		0	88	
	11.8	77	3	90		0	78	
Tanalith 3436	3.0	19	3	100	18	3	93	
	5.0	32	0	94		3	80	
	7.0	44	0	86		0	60	
	8.0	50	0	85		0	50	
	10.0	63	0	68		0	50	
Kreosot MTN 90	100	149	3	100	18	-	-	-
	100	138	-	-	-	18	90	
Acetylated wood		17[#]	29	100	13	5	70	
		20[#]	15	90		3	48	
		22[#]	6	84		-	-	
		22[#]	-	-		3	42	
NWPC Standard Preservative No 1	0.3	2.0	79	100	4.7	50	100	11
	1.3	8.9	15	100	21	3	58	
EN 252 CCA Reference	0.3	2.0	100		3.3	55	100	8
	1.5	10	15	100	23	0	60	
Untreated			100		1.6	98	100	3.4
Untreated Southern pine			100		1.2	-	-	

* The stakes were moved from Simlångsdalen old field to Simlångsdalen new field in 1996.

[#] The retention for the acetylated wood is expressed as average percent weight gain (based on 20 stakes for Simlångsdalen and 10 stakes for Viikki).

Field trial 1992

Table 48. NWPC Field trial 1992. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Tanalith 3485	$CuCO_3Cu(OH)_2$	20.5	Cu	11.8	Hickson Timber
	H_3BO_3	4.7	B	0.8	Products Ltd
	Tebuconazole	0.47	Tebu	0.47	
	Additives and H_2O	add 100			
ACQ 2100 C	CuO	9.2	Cu	8.5	CSI/Laporte
	DDAC	4.6	DDAC	4.6	
	NH_3 as carrier	9.2			
	H_2O	add 100			
NWPC Standard	CuO	19.0	Cu	15.2	-
Preservative No 1	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	
EN 252 CCA Reference	$CuSO_4 \cdot 5H_2O$	35.0	Cu	9.0	-
	$K_2Cr_2O_7$	45.0	Cr	16.0	
	$As_2O_5 \cdot 2H_2O$	20.0	As	11.0	

* Manufacturer that originally ordered the test.

Table 49. NWPC Field trial 1992. Results after 5 and 27 years' testing in Sweden and Denmark.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Tåstrup (Denmark) Year		
			5	27	$\bar{x}$	5	27	$\bar{x}$
Tanalith 3485	2.7	18	0	100	16	0	75	
	3.4	22	0	100	19	0	70	
	4.8	31	0	93		0	70	
	5.5	36	0	89		0	58	
	6.1	39	0	88		0	55	
ACQ 2100 C	0.33	2.2	20	100	8.6	7.5	100	17
	0.67	4.4	5	100	11	0	83	
	1.07	7.2	0	100	17	0	58	
	1.60	11	0	100	21	0	45	
	2.13	14	0	93		0	33	
NWPC Standard	0.3	2.1	71	100	5.4	55	100	7.6
Preservative No 1	1.3	9.0	0	100	16	0	58	
EN 252 CCA Reference	0.3	2.1	89	100	4.8	63	100	6
	1.5	10	7.5	100	18	5	60	
Untreated sapwood			100		3	98	100	4.4
Untreated heartwood			25	100	14	-	-	

* The stakes were installed in Simlångsdalen new field.

Field trial 1993

Table 50. NWPC Field trial 1993. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Tanalith 3488	$CuCO_3Cu(OH)_2$	21.5	Cu	12.4	Hickson Timber
	H_3BO_3	4.5	B	0.8	Products Ltd
	Propiconazole	0.45	Propi	0.45	
	Additives and H_2O	add 100			
Impralit Test product	$CuCO_3Cu(OH)_2$	16.7	Cu	9.6	Weyl GmbH
	H_3BO_3	6.2	B	1.1	
	Polymeric betain	7.7	P betain	7.7	
	Solvent, additives, H_2O	add 100			
NWPC Standard	CuO	19.0	Cu	15.2	-
Preservative No 1	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	
EN 252 CCA Reference	$CuSO_4 \cdot 5H_2O$	35.0	Cu	9.0	-
	$K_2Cr_2O_7$	45.0	Cr	16.0	
	$As_2O_5 \cdot 2H_2O$	20.0	As	11.0	

* Manufacturer that originally ordered the test.

Table 51. NWPC Field trial 1993. Results after 5 and 26 years' testing in Sweden and Norway.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Sørkedalen (Norway) Year		
			5	26	$\bar{x}$	5	26	$\bar{x}$
Tanalith 3488	2.6	17	0	100	17	5	98	
	3.3	22	0	100	19	5	85	
	4.6	30	0	100	22	5	80	
	5.2	34	0	93		3	73	
	5.9	39	0	89		3	63	
Impralit Test product	0.4	2.6	90	100	5	35	100	10
	0.8	5.2	56	100	6.3	30	100	11
	1.0	6.6	25	100	7.8	20	100	12
	1.3	8.4	13	100	9	23	100	13
	1.6	10	3	100	11	10	100	17
	1.8	12	1	100	11	13	100	15
	2.3	15	0	100	12	3	98	
NWPC Standard	0.3	2.0	64	100	6.3	28	100	10
Preservative No 1	1.3	8.9	3	100	20	0	58	
EN 252 CCA Reference	0.3	2.0	79	100	5.5	33	100	10
	1.3	8.9	11	100	19	5	88	
Untreated			100		3.6	63	100	6.7

* The stakes were installed in Simlångsdalen new field.

Field trial 1995

Table 52. NWPC Field trial 1995. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
Rentokil ACB	$CuSO_4 \cdot 5H_2O$	28.0	Cu	7.1	Rentokil Svenska AB
	H_3BO_3	25.5	B	4.5	
	NH_3	12.4			
	$(NH_4)_2CO_3$	8.9			
	Inert ingredients and H_2O	add 100			
NWPC Standard Preservative No 1	CuO	19.0	Cu	15.2	-
	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	
EN 252 CCA Reference	$CuSO_4 \cdot 5H_2O$	35.0	Cu	9.0	-
	$K_2Cr_2O_7$	45.0	Cr	16.0	
	$As_2O_5 \cdot 2H_2O$	20.0	As	11.0	

* Manufacturer that originally ordered the test.

Table 53. NWPC Field trial 1995. Results after 5, 24 (Sweden) and 18 (Finland) years' testing.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Viikki (Finland) Year		
			5	24	$\bar{x}$	5	18	$\bar{x}$
Rentokil ACB	5.4	36	0	83		10	83	
	6.0	40	0	76		18	75	
	6.6	43	0	68		10	65	
	7.3	48	0	56		10	63	
	8.0	52	0	55		13	55	
NWPC Standard Preservative No 1	0.3	2.0	69	100	6.2	84	100	6.4
	1.3	8.9	1	95		5	53	
EN 252 CCA Reference	0.3	2.0	81	100	5.6	70	100	7.3
	1.3	8.9	0	90		8	63	
Untreated 1			95	100	4	98	100	4.1
Untreated 2			100		3.3	100		4

* The stakes were installed in Simlångsdalen new field.

Field trial 1996

Table 54. NWPC Field trial 1996. Preservatives tested and their chemical formulation.

Wood preservative	Chemical formulation % m/m		Active components % m/m		Manufacturer*
INjecta A Flytande	CuO	8.7	Cu	7.0	INjecta ApS
	$HOC(CH_3COOH)_2COOH$	5.3			
	NH_3	12.2			
	CO_2	4.4			
	H_2O	add 100			
Tanalith E 3491	$CuCO_3Cu(OH)_2$	20.5	Cu	11.3	Hickson Timber
	H_3BO_3	4.5	B	0.8	Products Ltd
	Tebuconazole (techn)	0.48	Tebu	0.45	
	Complexing agents and H_2O	add 100			
NWPC Standard	CuO	19.0	Cu	15.2	-
Preservative No 1	CrO_3	36.0	Cr	18.7	
	As_2O_5	45.0	As	29.3	
EN 252 CCA Reference	$CuSO_4 \cdot 5H_2O$	35.0	Cu	9.0	-
	$K_2Cr_2O_7$	45.0	Cr	16.0	
	$As_2O_5 \cdot 2H_2O$	20.0	As	11.0	

* Manufacturer that originally ordered the test.

Table 55. NWPC Field trial 1996. Results after 5 and 23 years' testing in Sweden and Denmark.

Wood preservative	Concentration % m/m	Retention kg/m^3	Index of decay and average life ($\bar{x}$) Simlångsdalen (Sweden)* Year			Tåstrup (Denmark) Year		
			5	23	$\bar{x}$	5	23	$\bar{x}$
INjecta A Flytande	3.5	23	11	100	14	10	98	
	6.9	46	1	100	20	0	65	
	10.5	69	1	84		0	42	
	14.0	91	4	76		0	35	
	17.6	113	3	69		0	28	
Tanalith E 3491	1.4	9.2	11	100	11	25	100	12
	2.2	14	1	100	17	10	88	
	2.8	18	1	98		3	80	
	3.6	24	3	81		0	78	
	5.0	33	3	81		0	70	
NWPC Standard	0.3	2.0	55	100	8.0	43	100	11
Preservative No 1	1.3	8.9	5	95		0	53	
EN 252 CCA Reference	0.3	2.1	69	100	6.6	38	100	11
	1.3	8.9	1	90		3	53	
Untreated			100		3.3	100	-	3.5

* The stakes were installed in Simlångsdalen new field.

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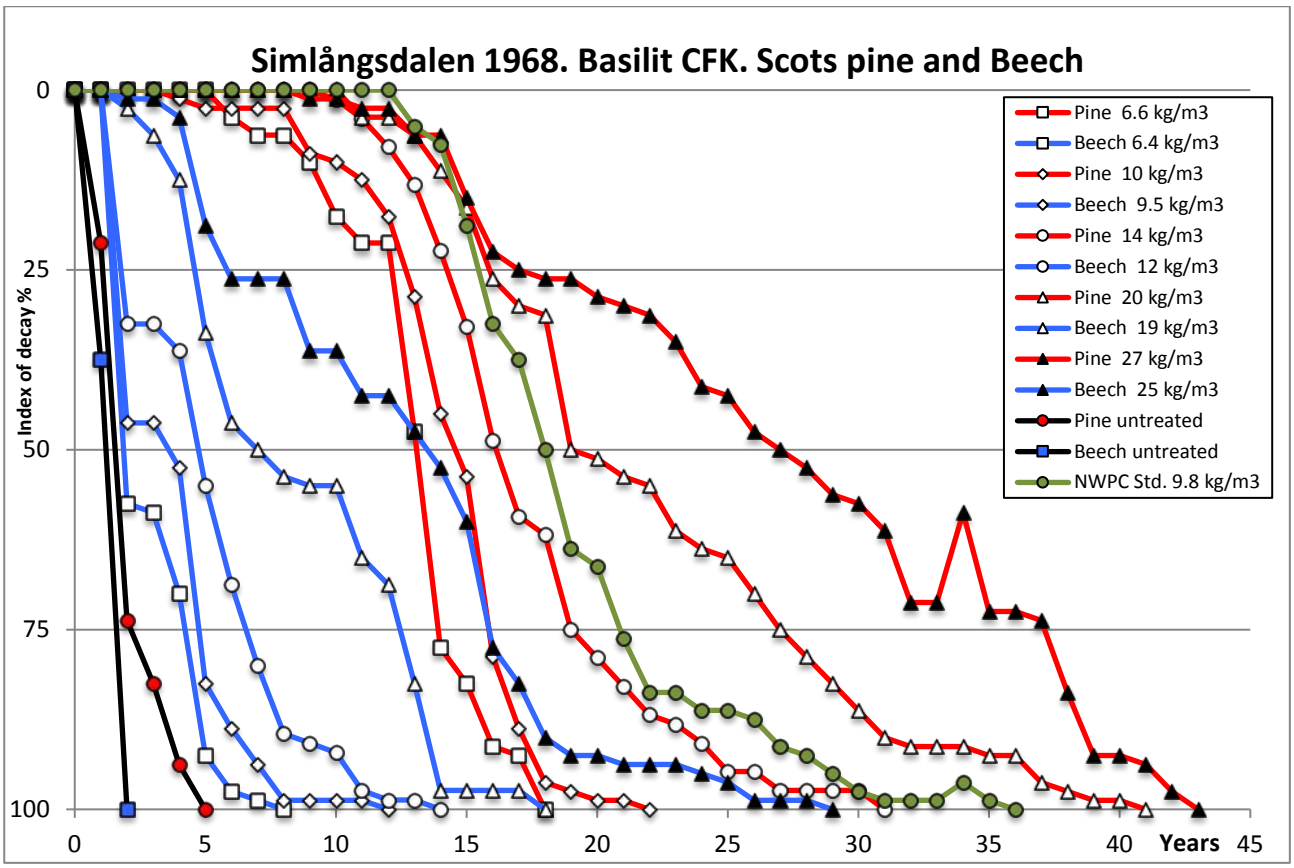
Figures 7 to 134 give the rate of decay for stakes in the different trials.



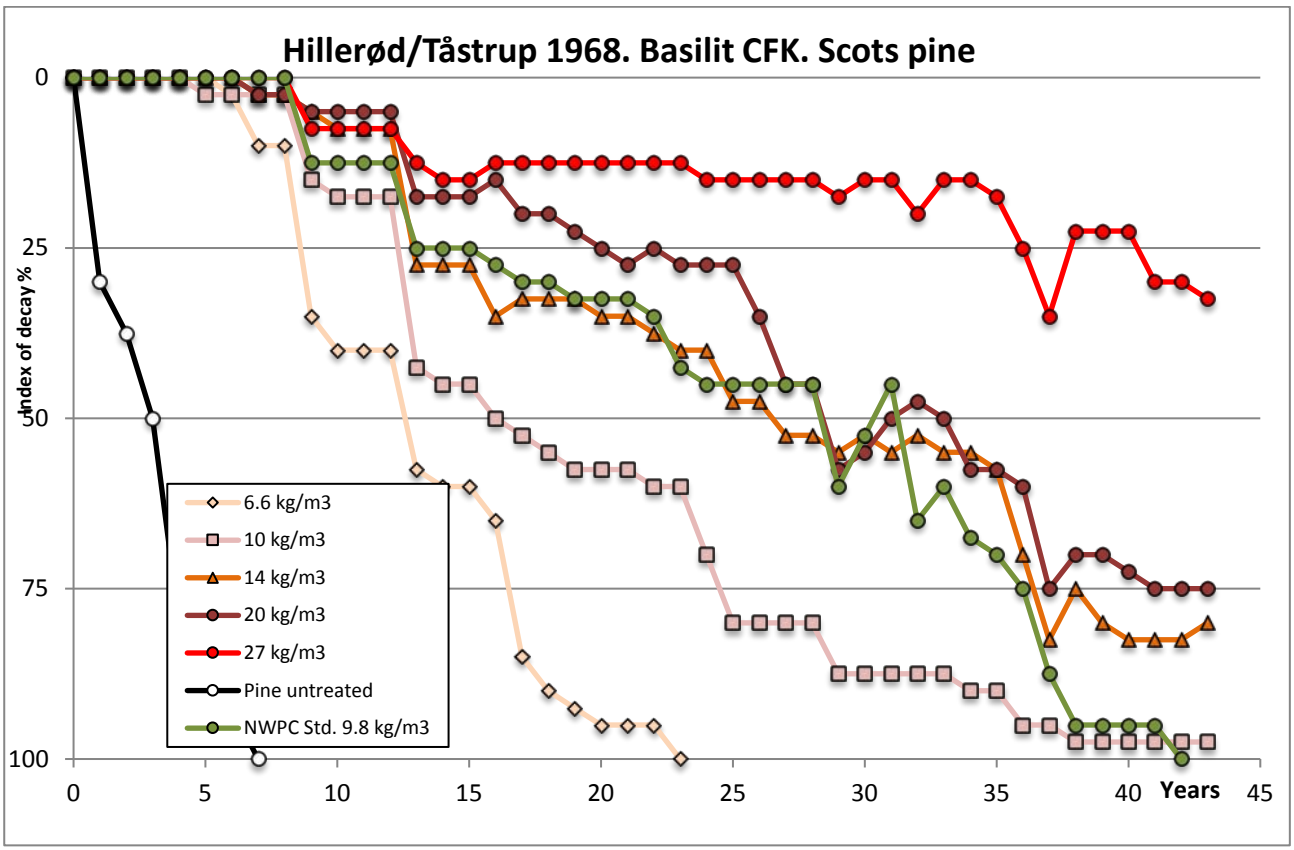
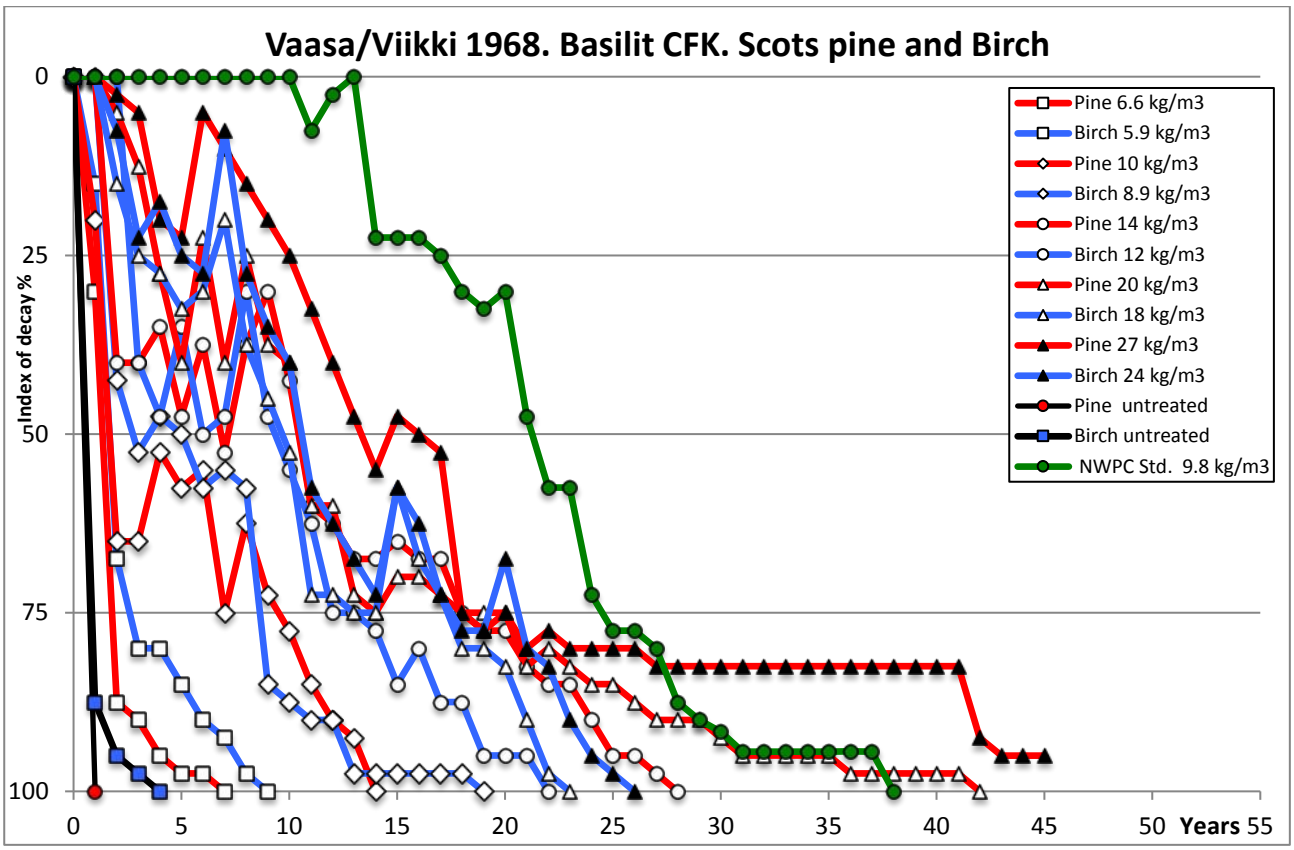


Figure 7. Field trial 1968. Index of decay for stakes of Scots pine and Beech (Simlångsdalen only) treated with Basilit CFK.



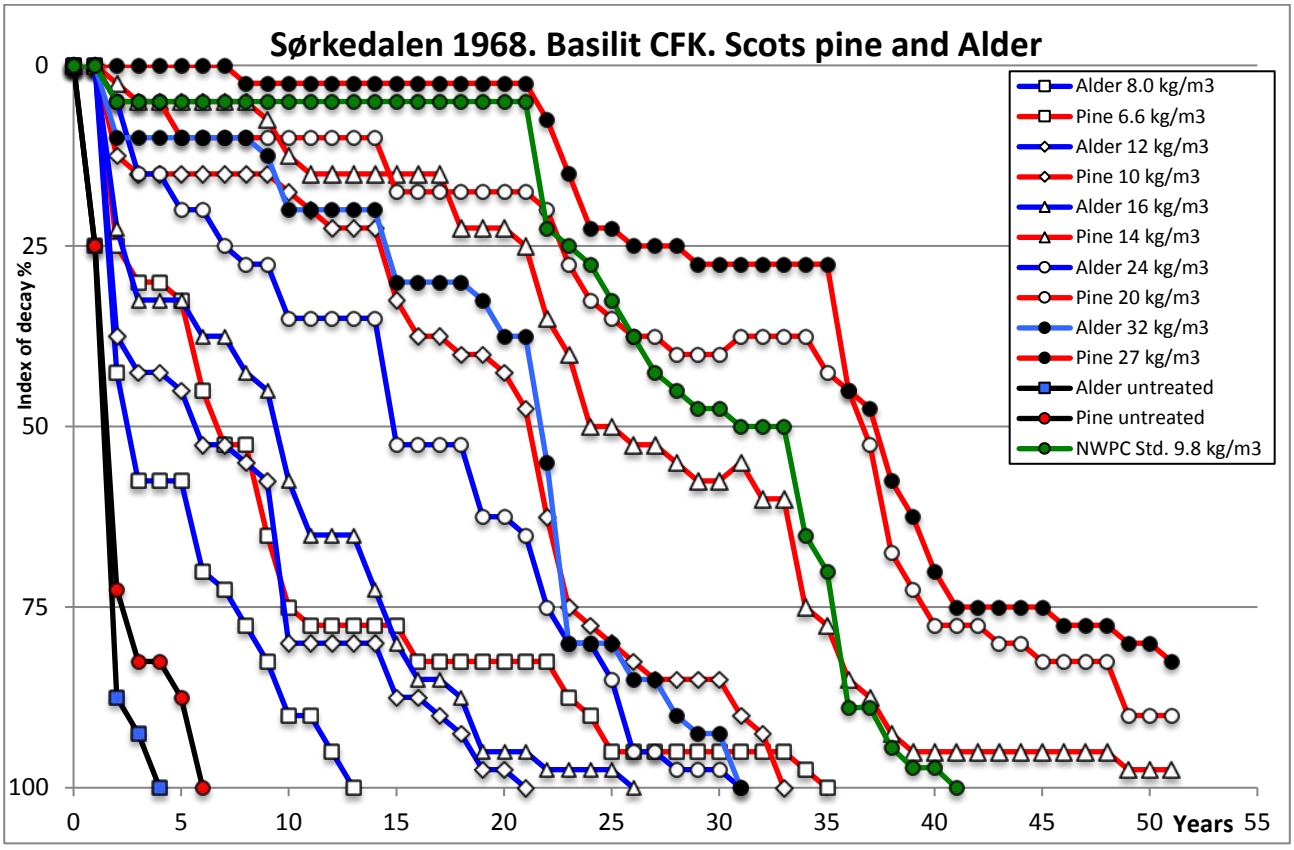
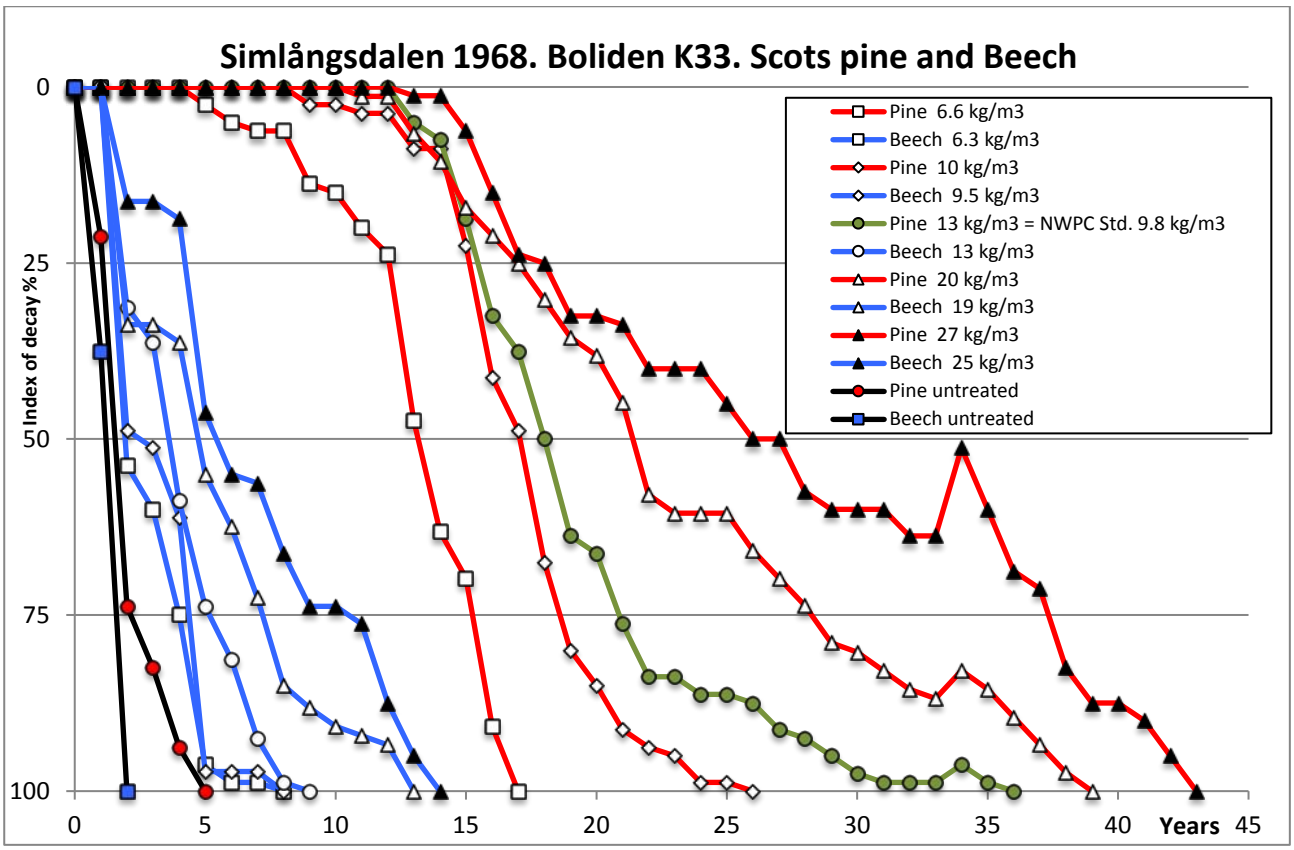


Figure 8. Field trial 1968. Index of decay for stakes of Scots pine, Birch (Vaasa/Viikki) and Alder (Sørkedalen) treated with Basilit CFK.



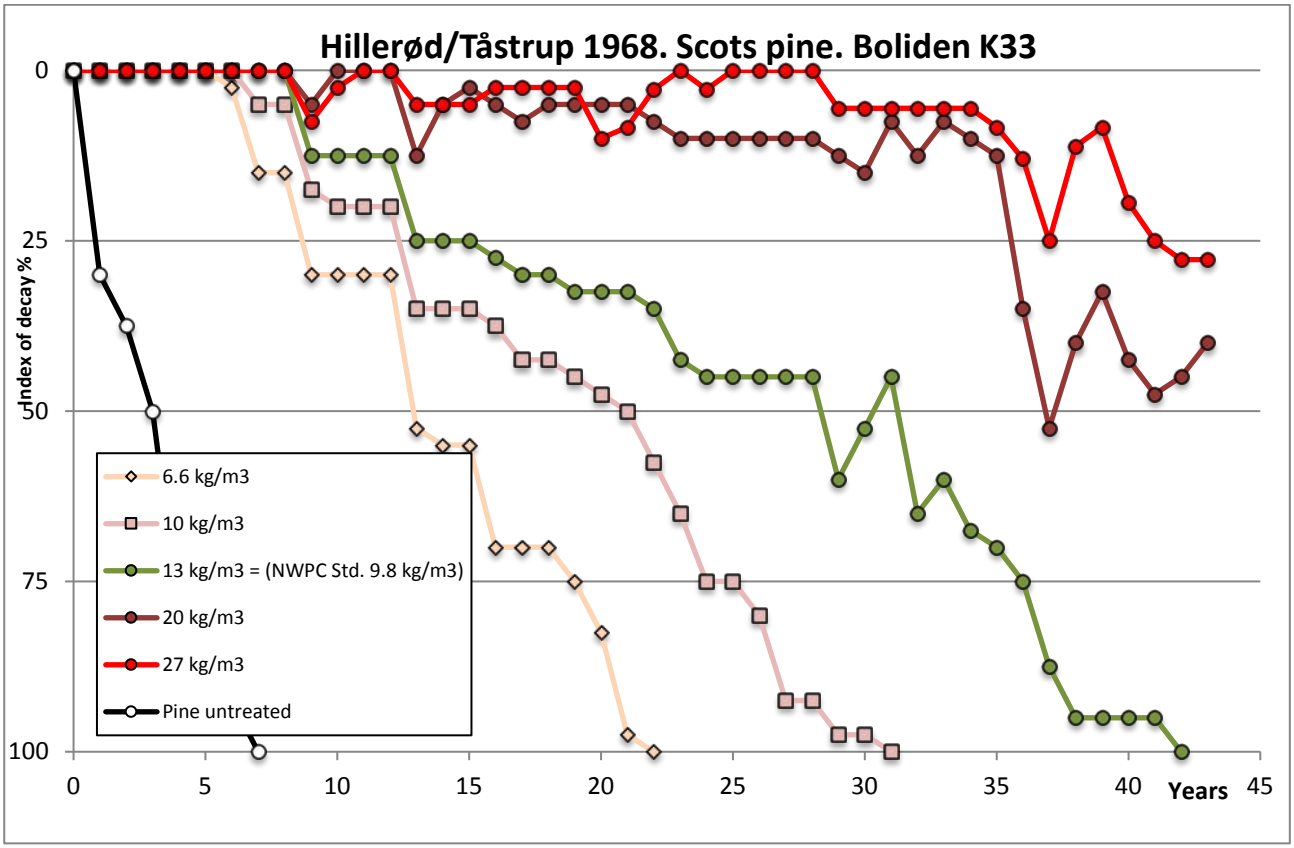
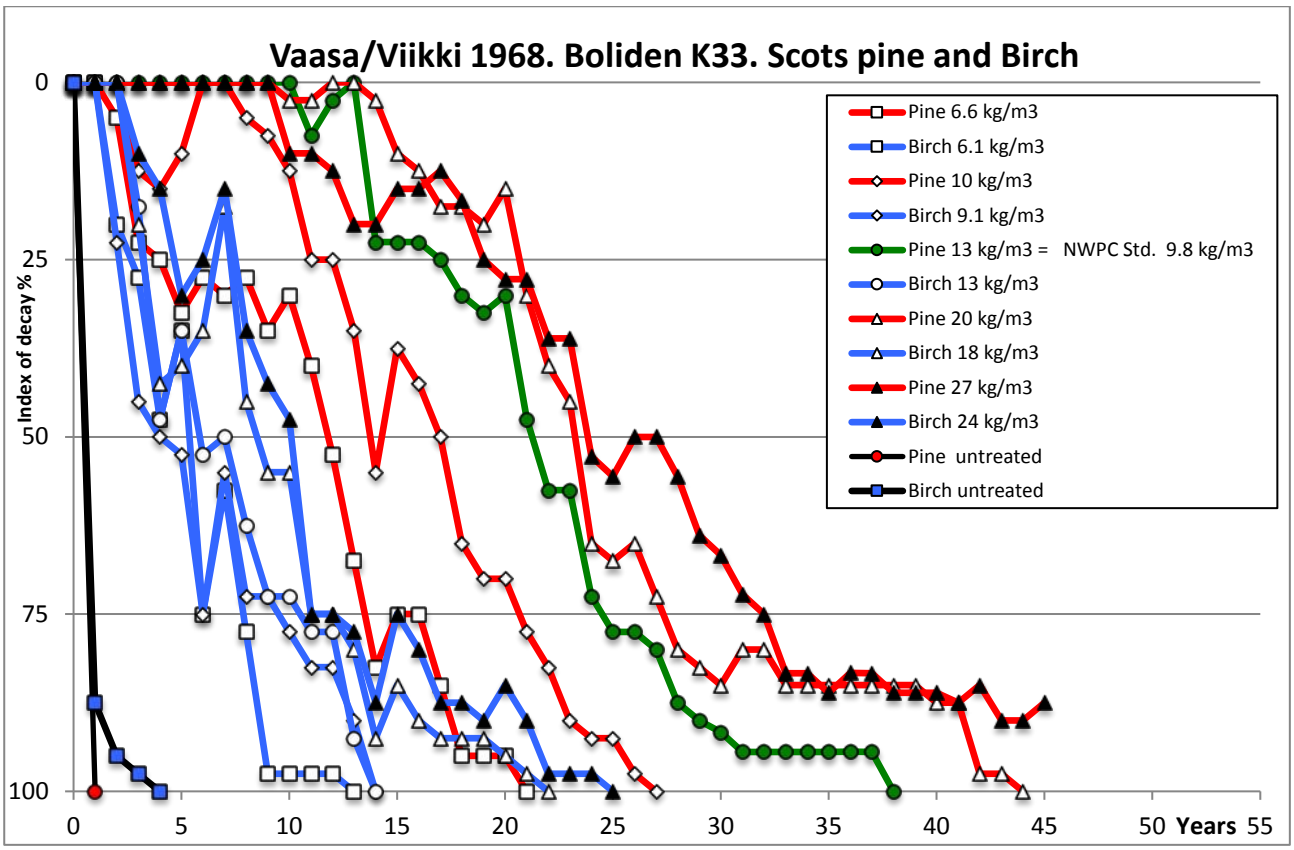


Figure 9. Field trial 1968. Index of decay for stakes of Scots pine and Beech (Simlångsdalen only) treated with Boliden K33.



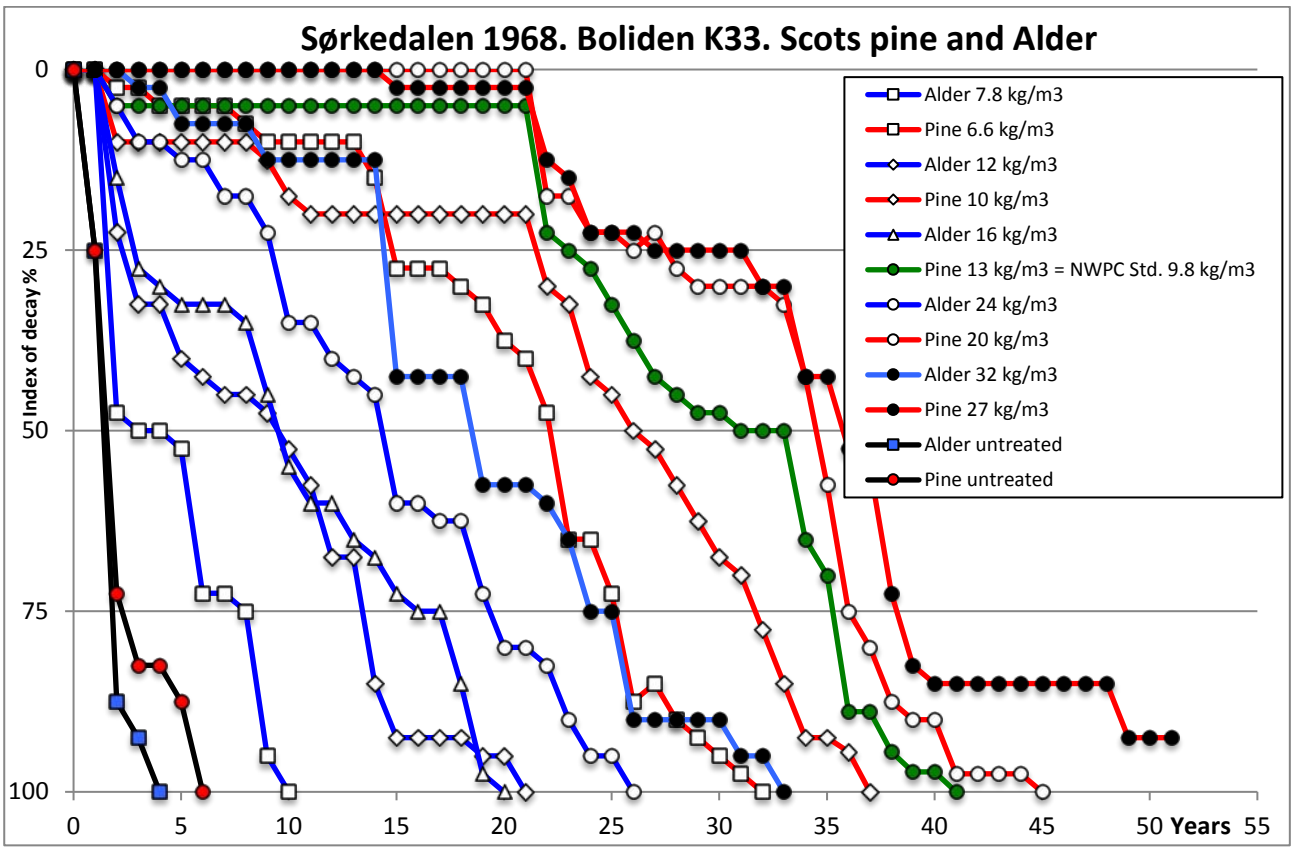
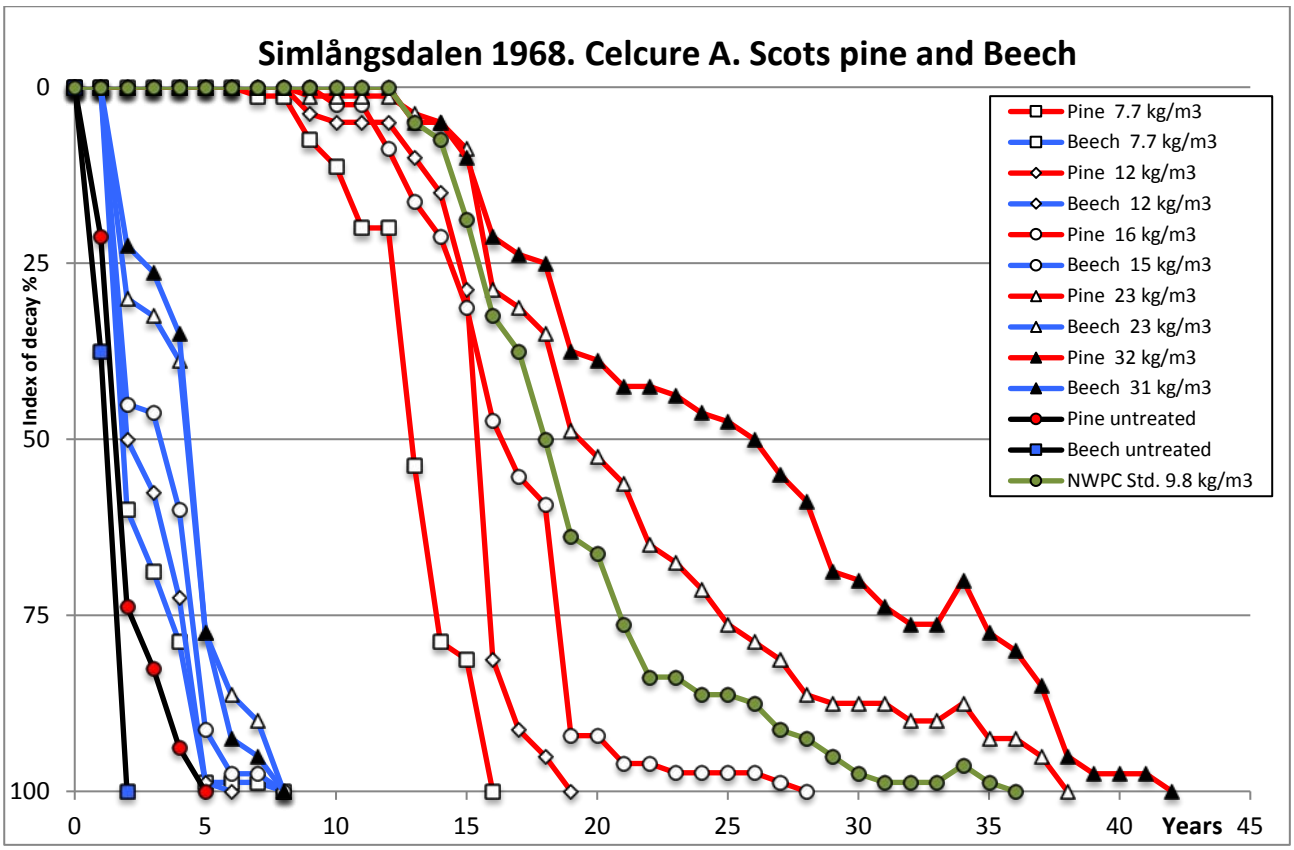


Figure 10. Field trial 1968. Index of decay for stakes of Scots pine, Birch (Vaasa/Viikki) and Alder (Sørkedalen) treated with Boliden K33.



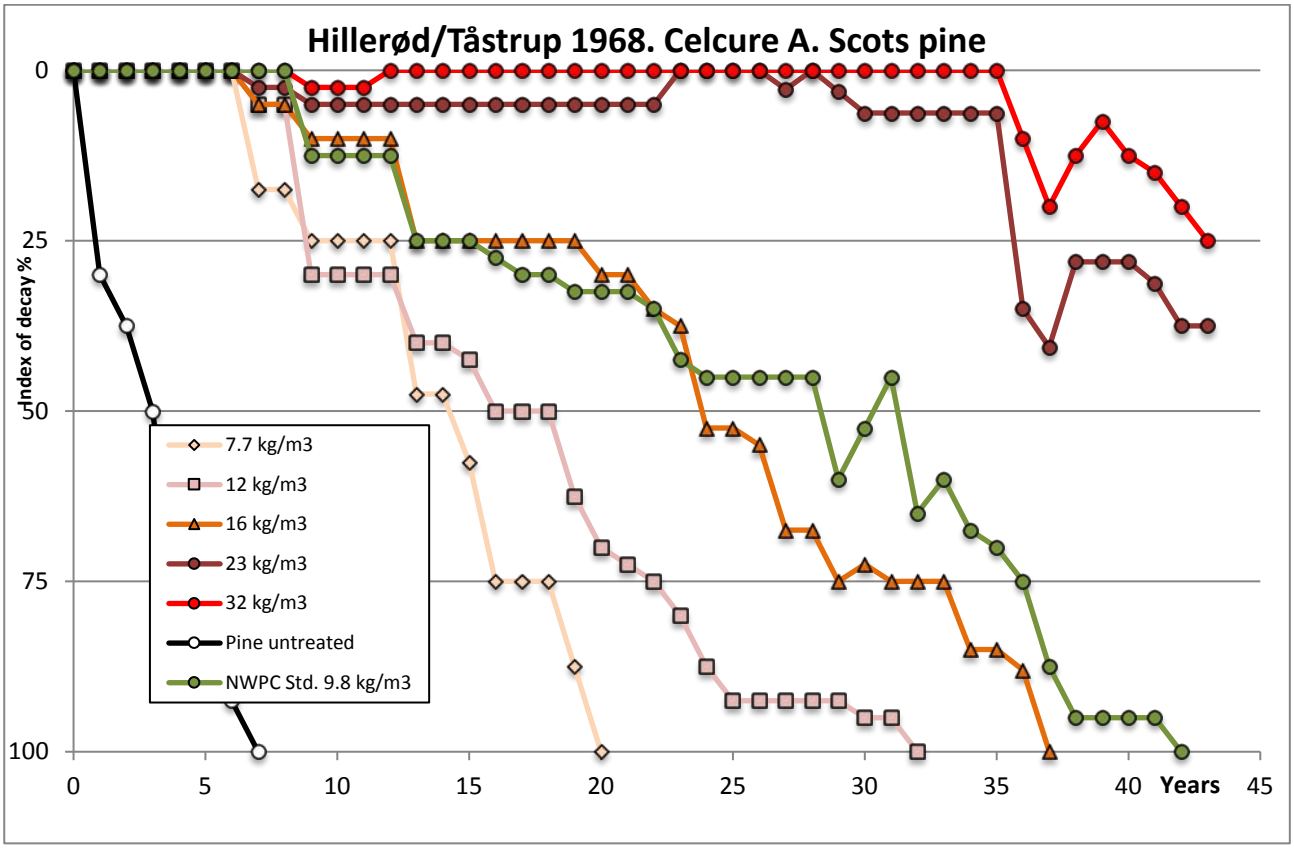
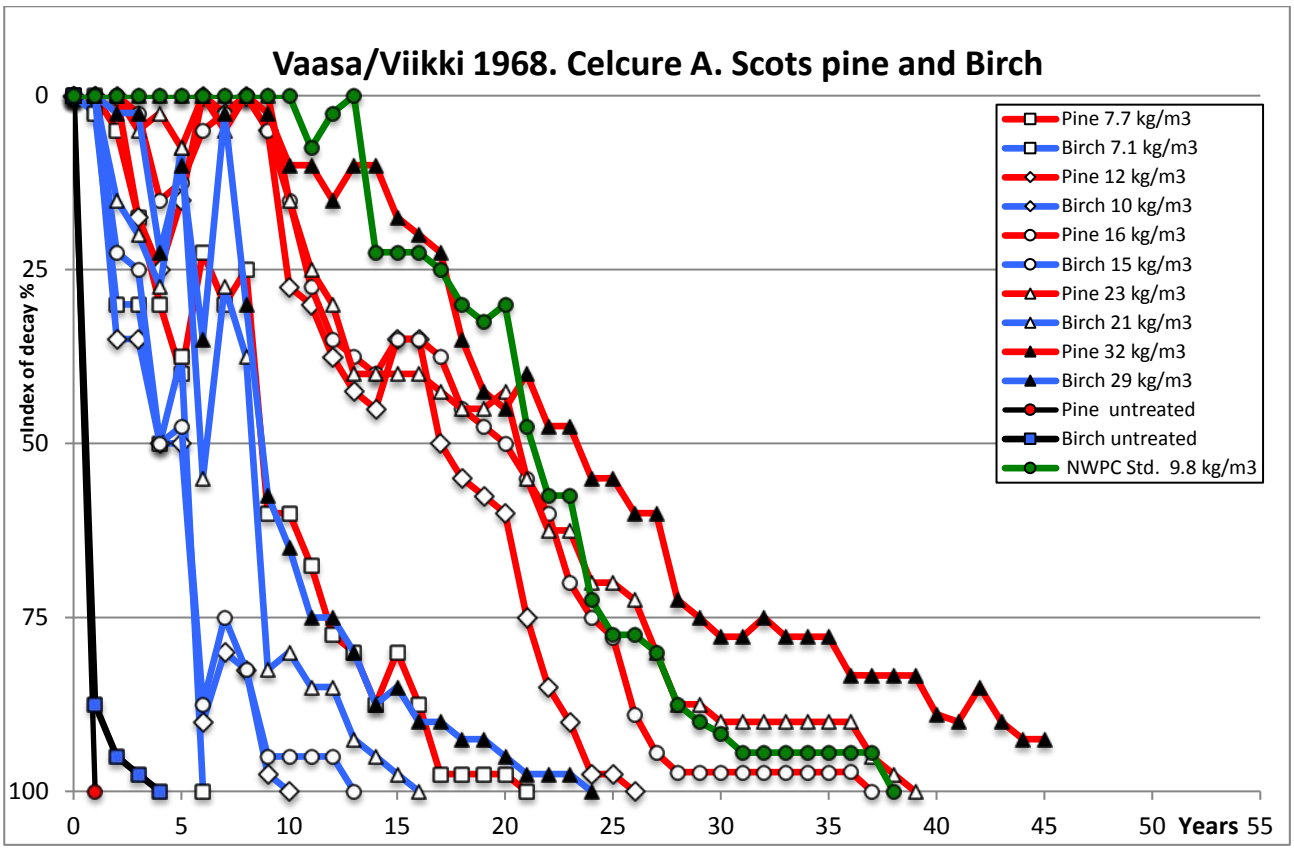


Figure 11. Field trial 1968. Index of decay for stakes of Scots pine and Beech (Simlångsdalen only) treated with Celcure A.



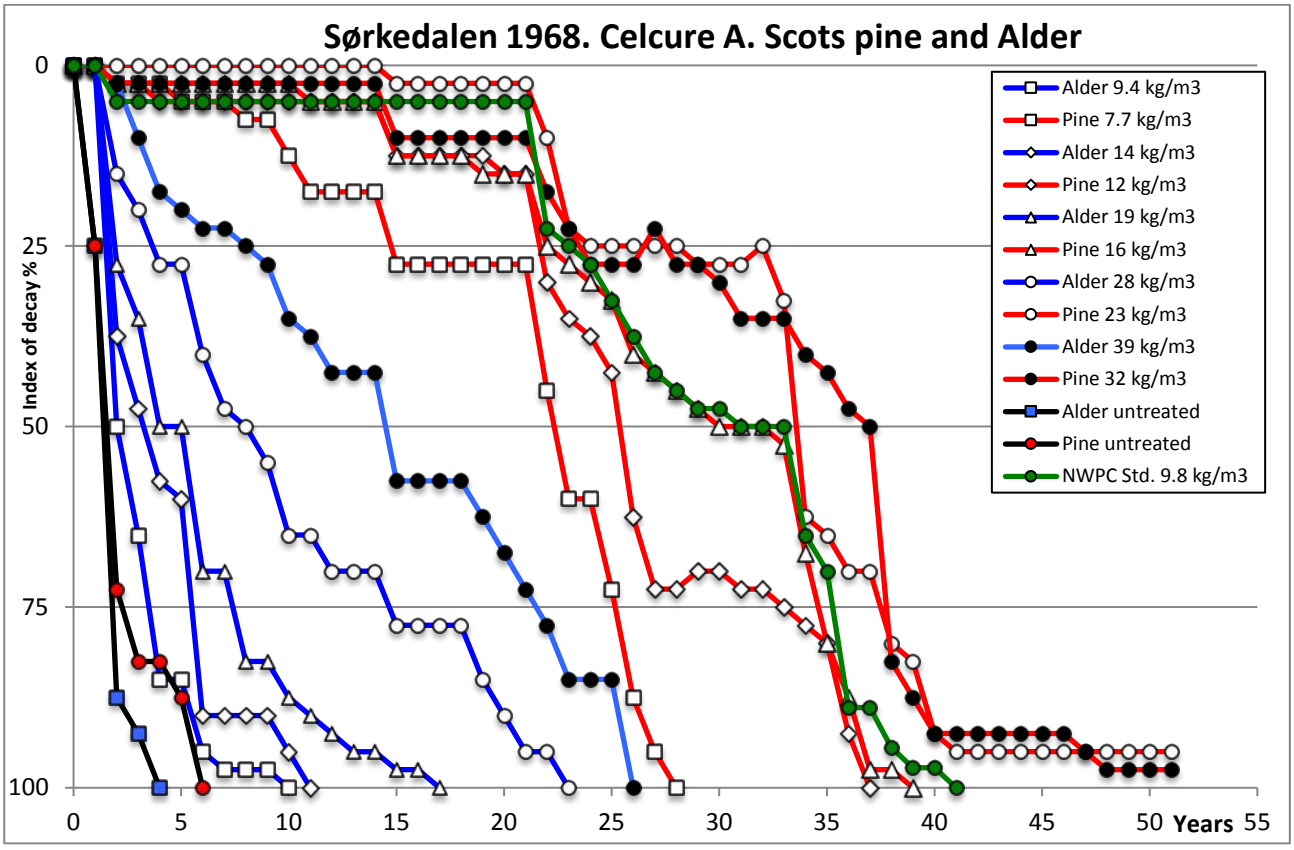
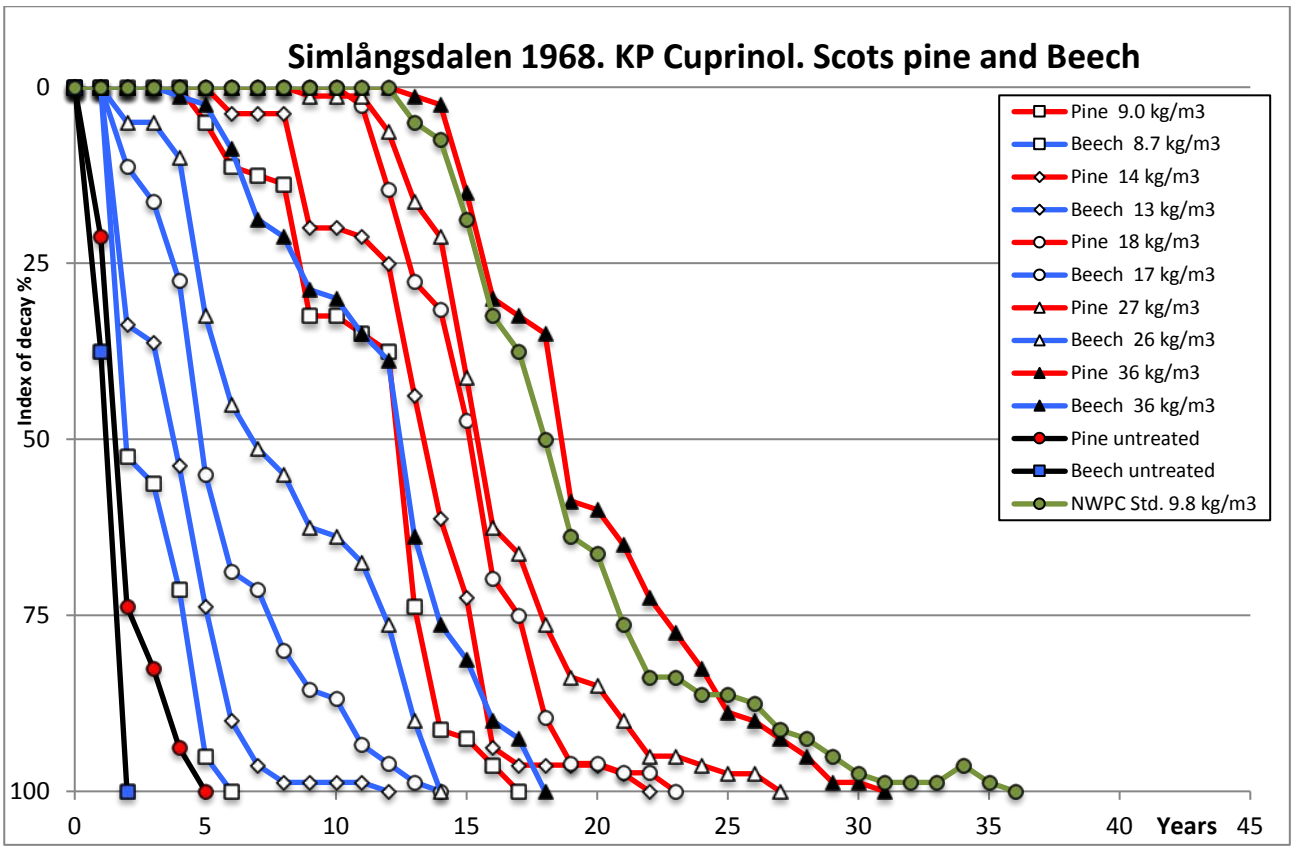


Figure 12. Field trial 1968. Index of decay for stakes of Scots pine, Birch (Vaasa/Viikki) and Alder (Sørkedalen) treated with Celcure A.



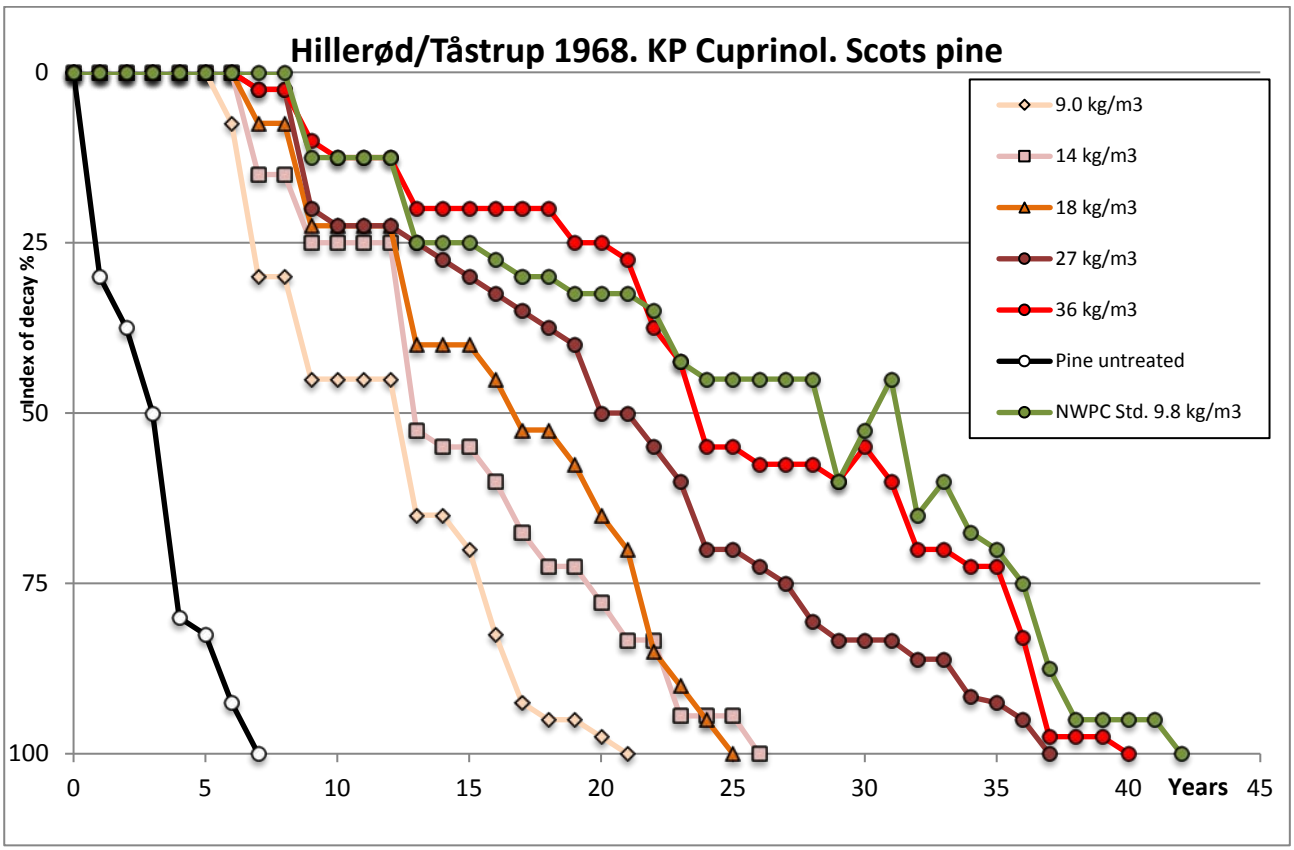
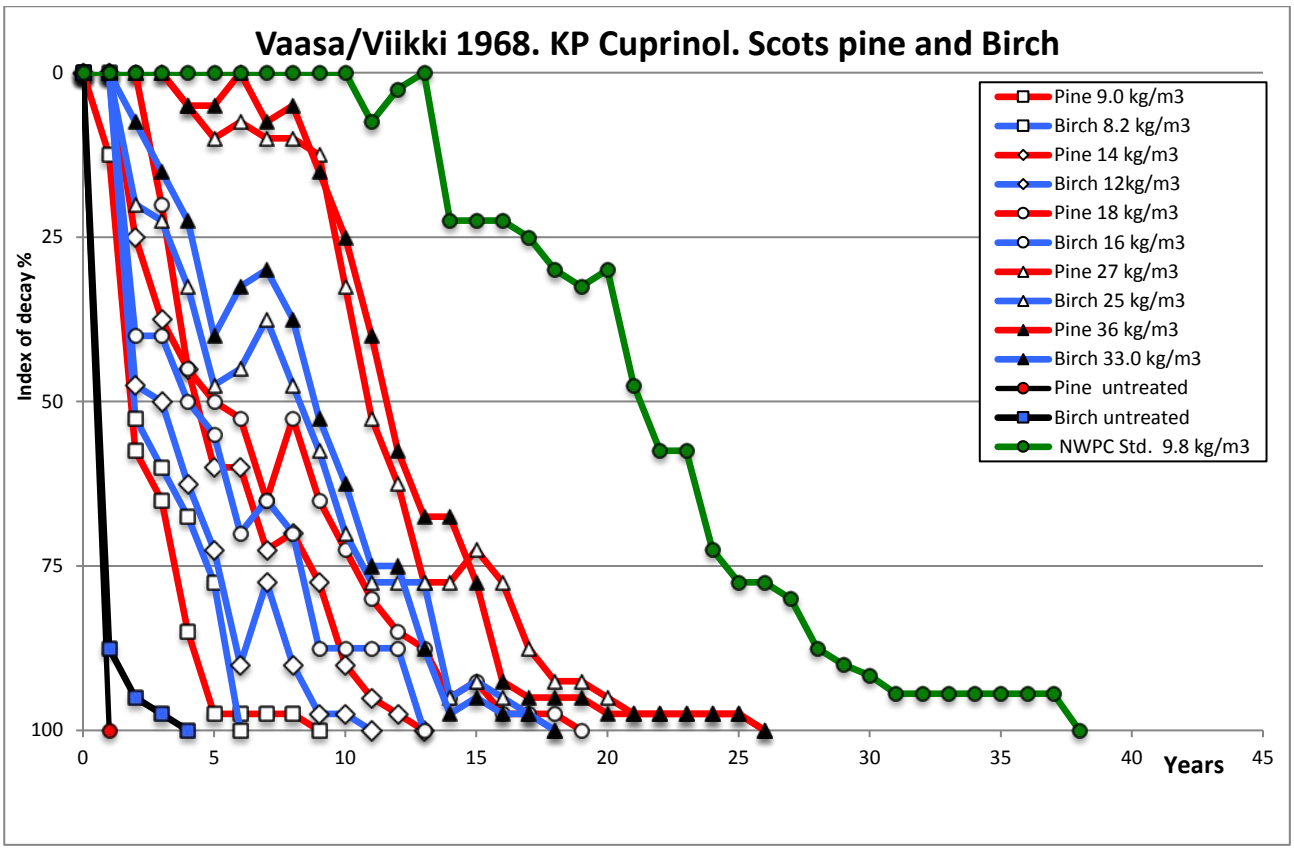


Figure 13. Field trial 1968. Index of decay for stakes of Scots pine and Beech (Simlångsdalen only) treated with KP Cuprinol.



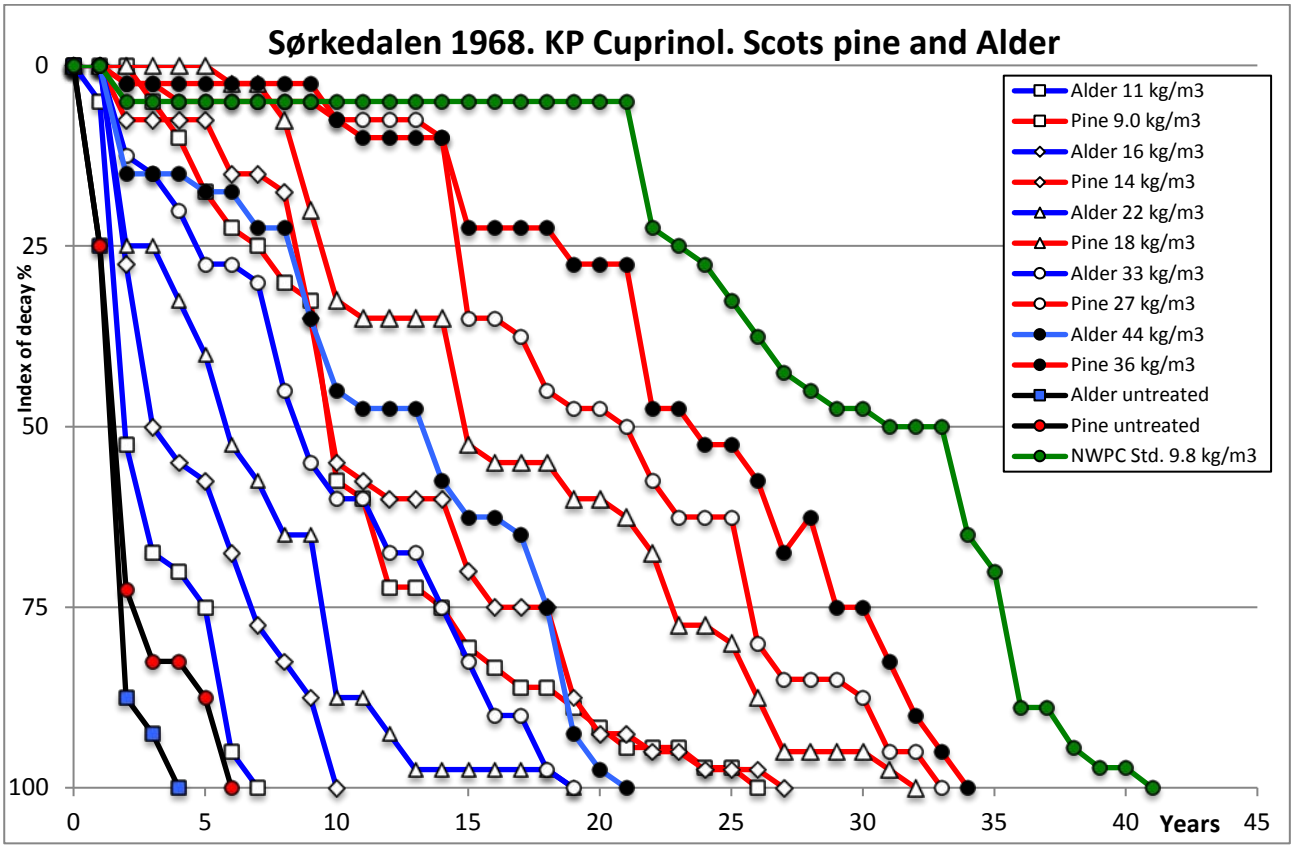
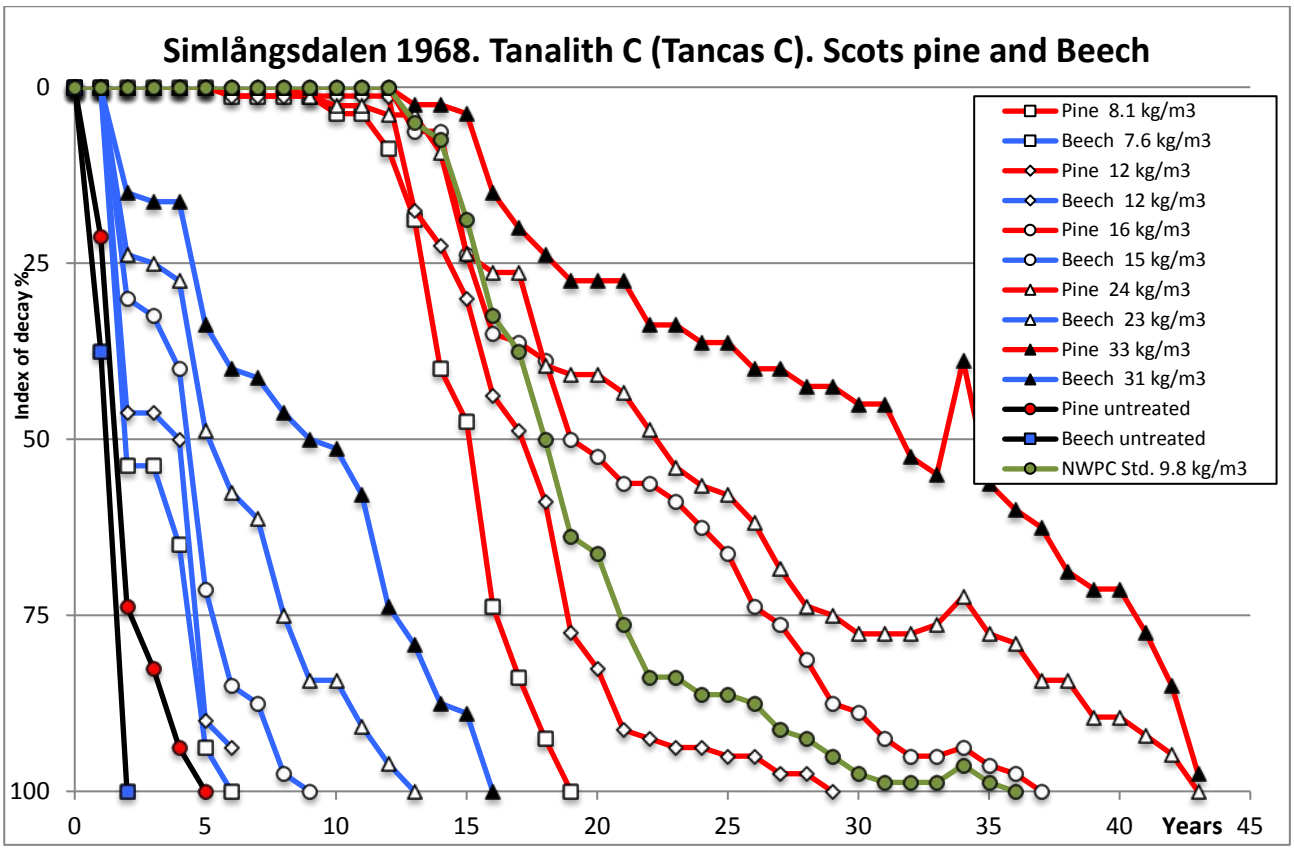


Figure 14. Field trial 1968. Index of decay for stakes of Scots pine, Birch (Vaasa/Viikki) and Alder (Sørkedalen) treated with KP Cuprinol.



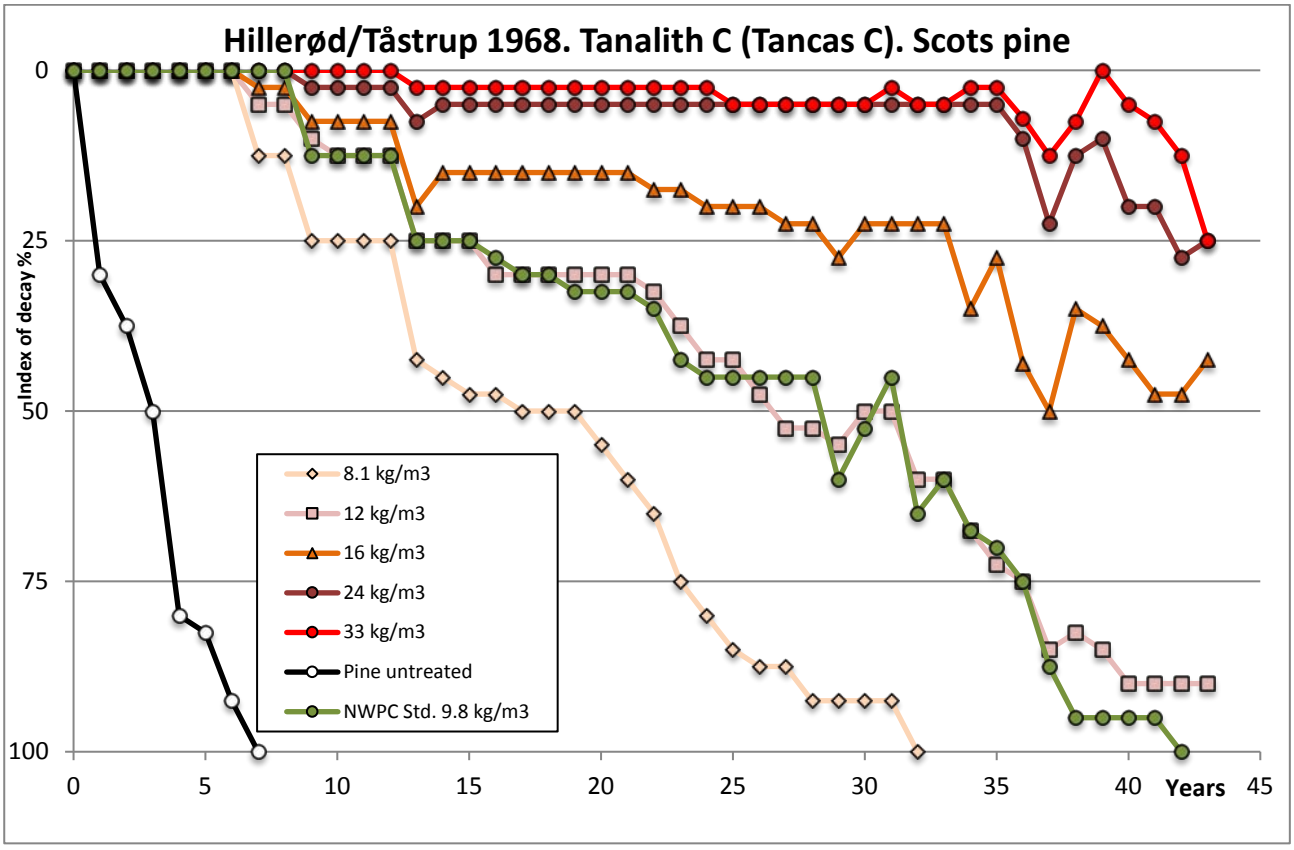
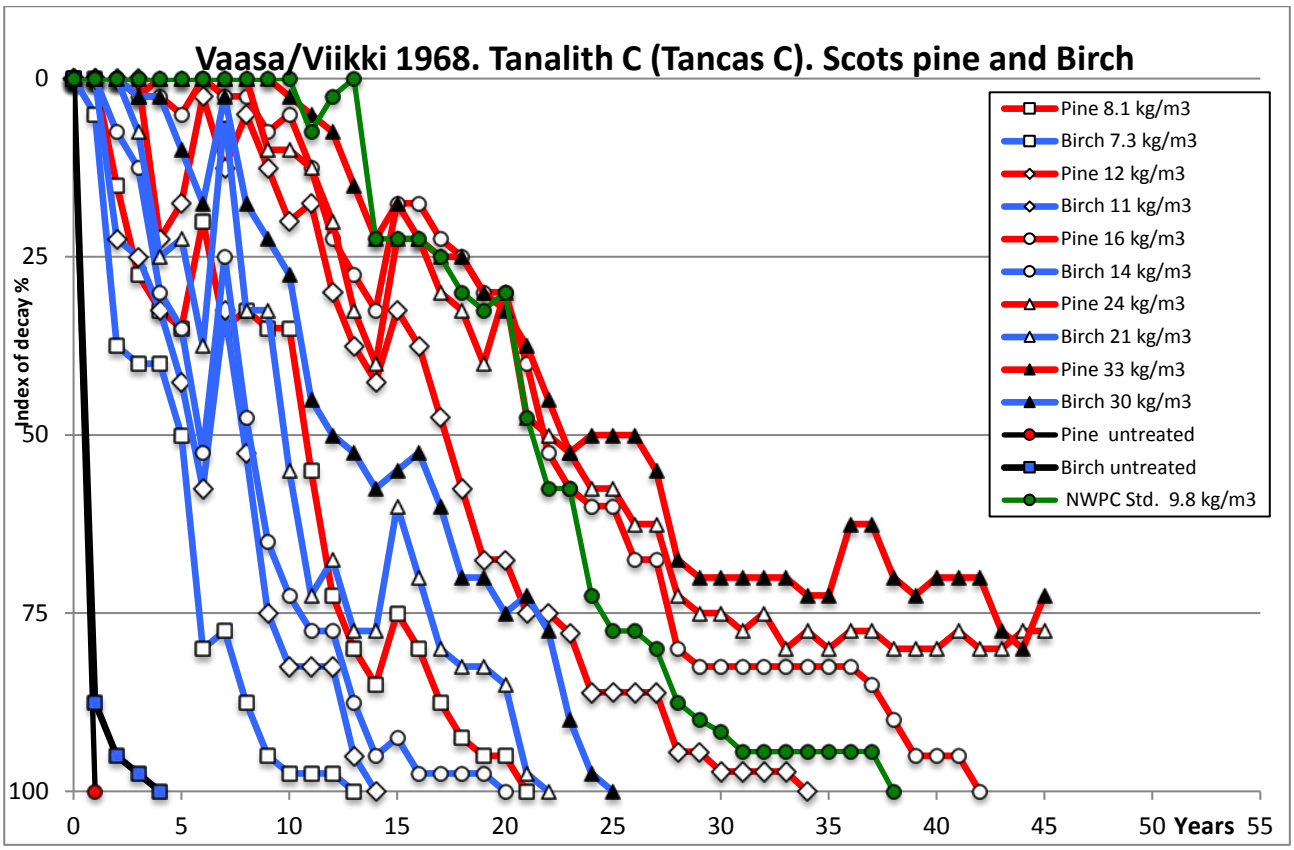


Figure 15. Field trial 1968. Index of decay for stakes of Scots pine and Beech (Simlångsdalen only) treated with Tanalith C (Tancas C).



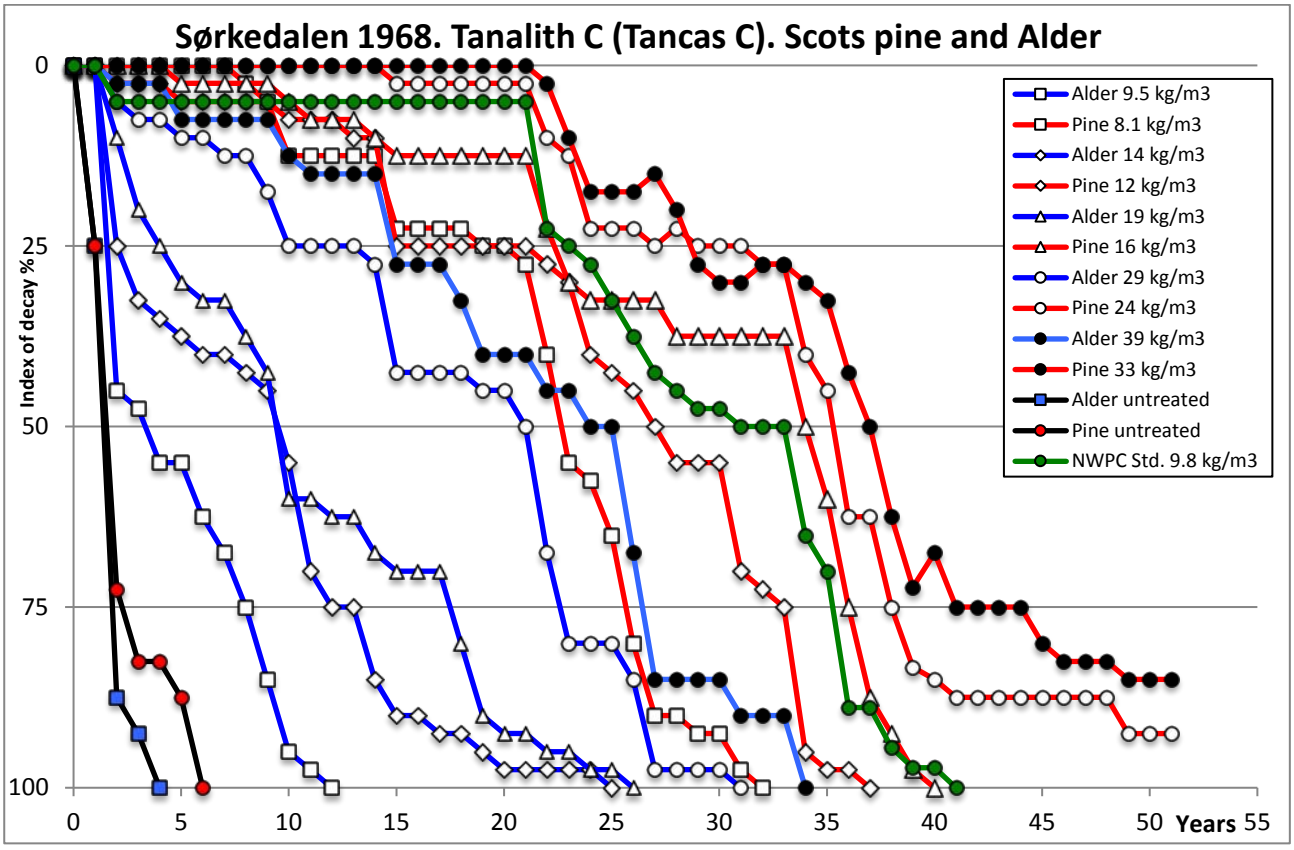
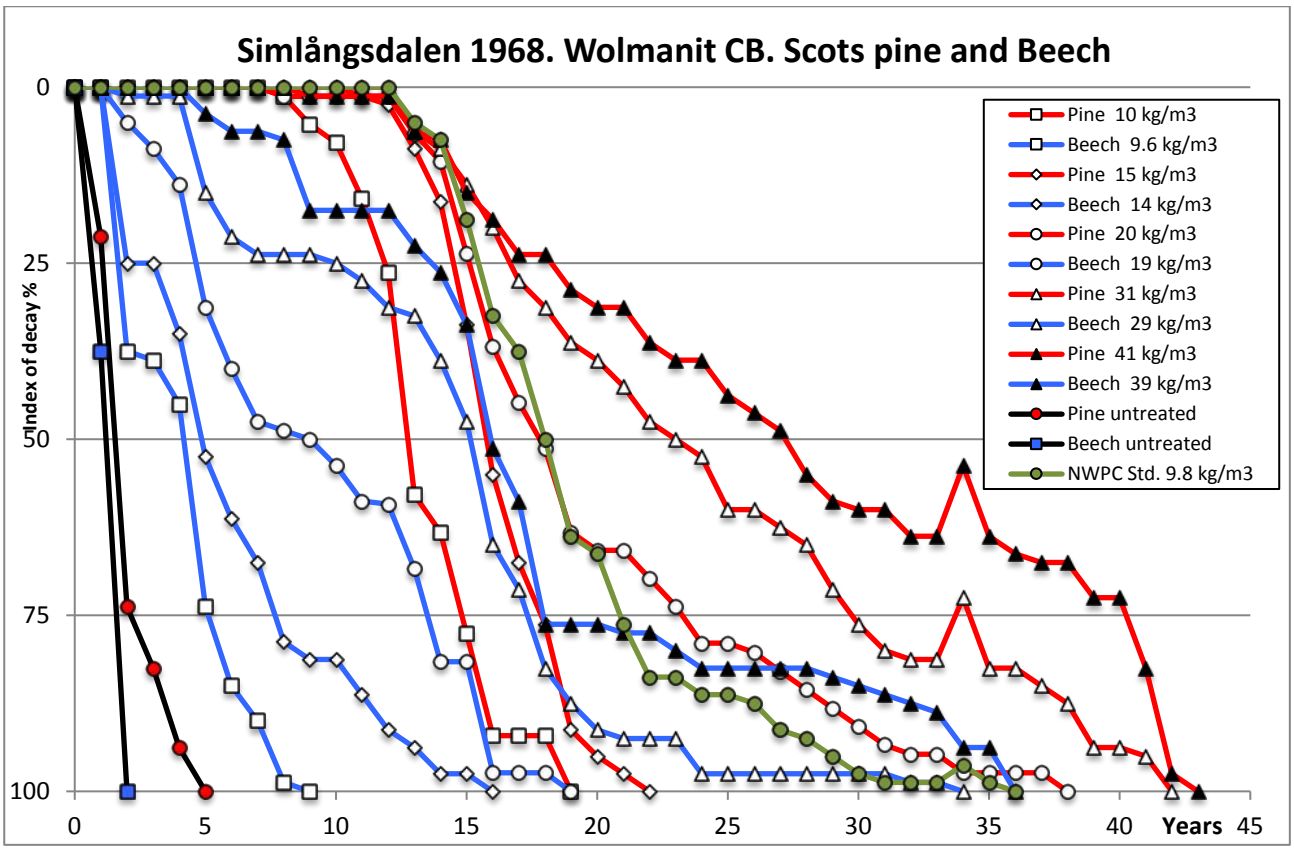


Figure 16. Field trial 1968. Index of decay for stakes of Scots pine, Birch (Vaasa/Viikki) and Alder (Sørkedalen) treated with Tanalith C (Tancas C).



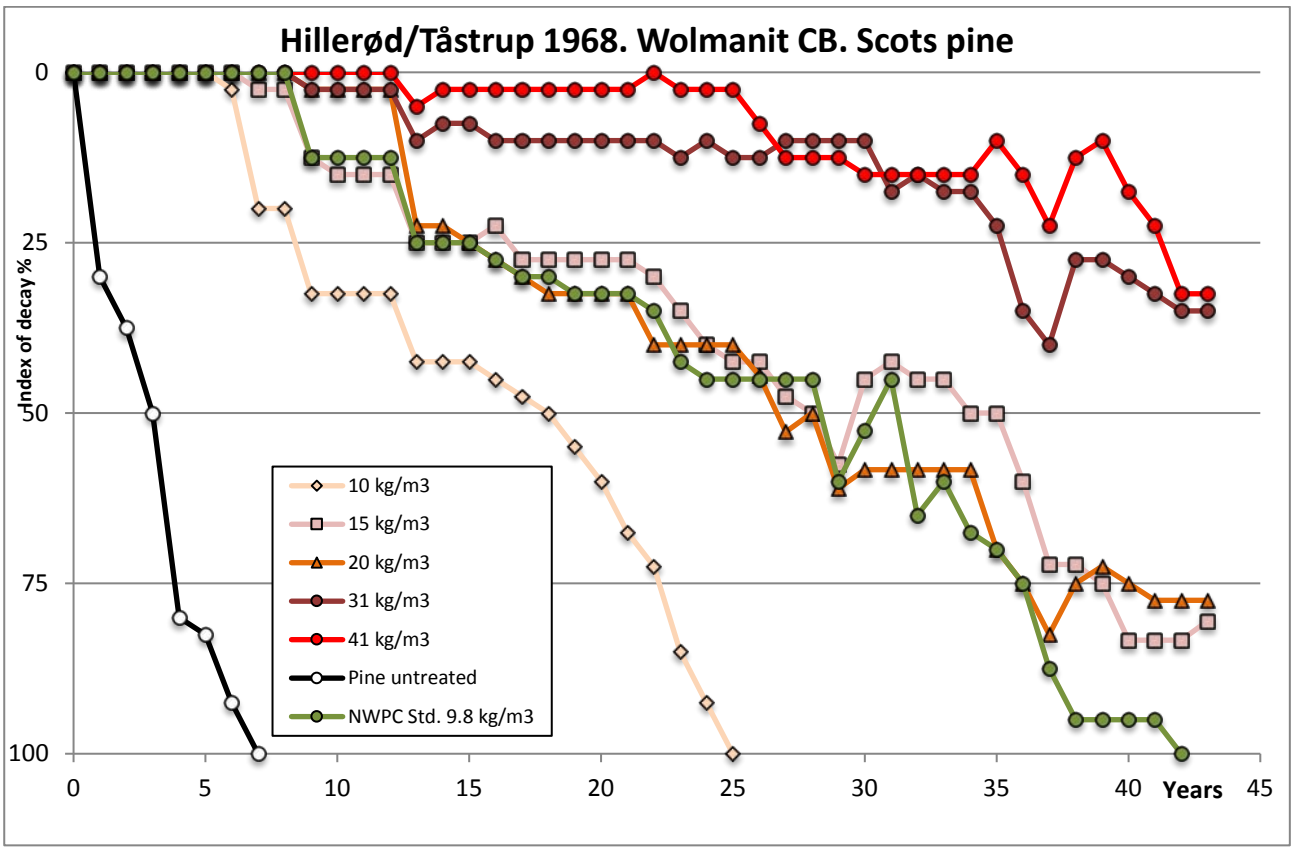
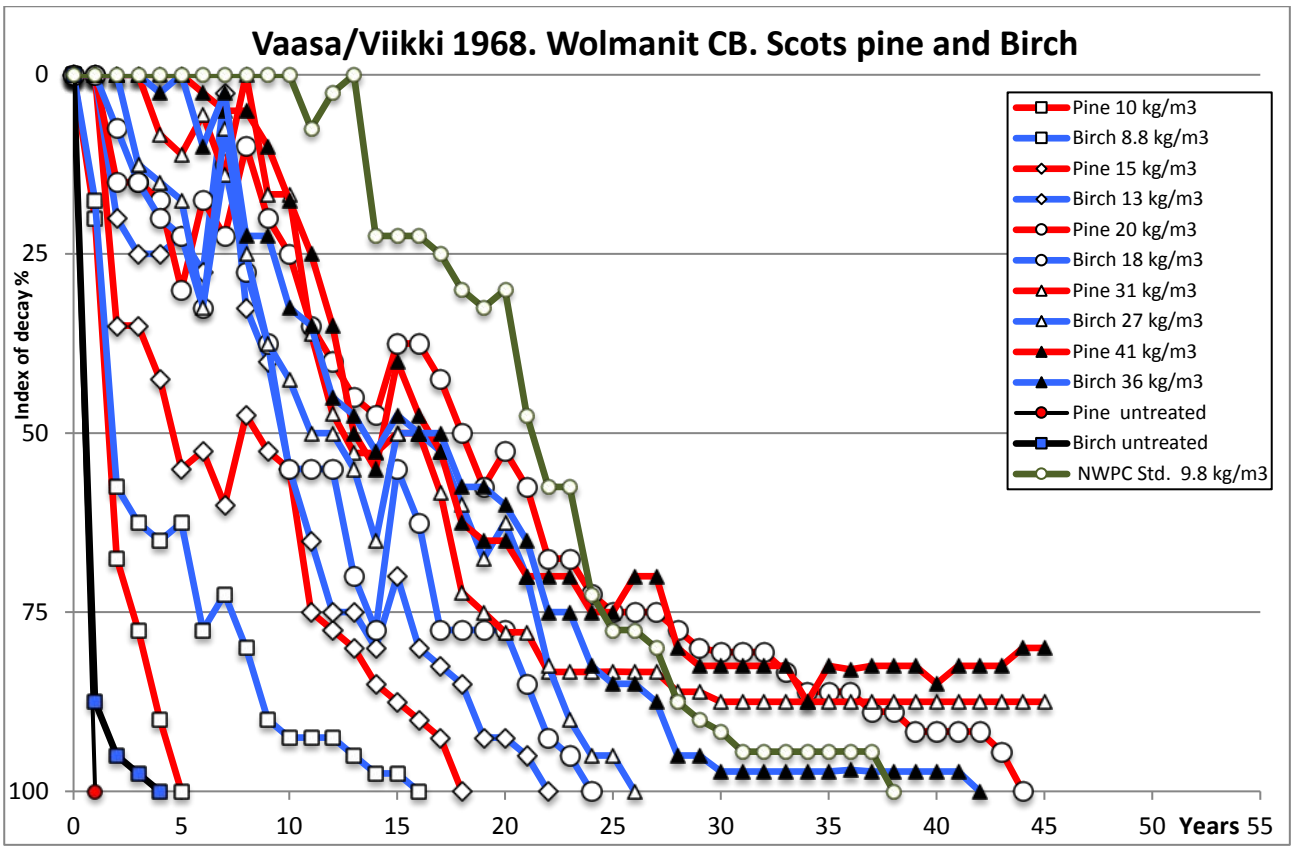


Figure 17. Field trial 1968. Index of decay for stakes of Scots pine and Beech (Simlångsdalen only) treated with Wolmanit CB.



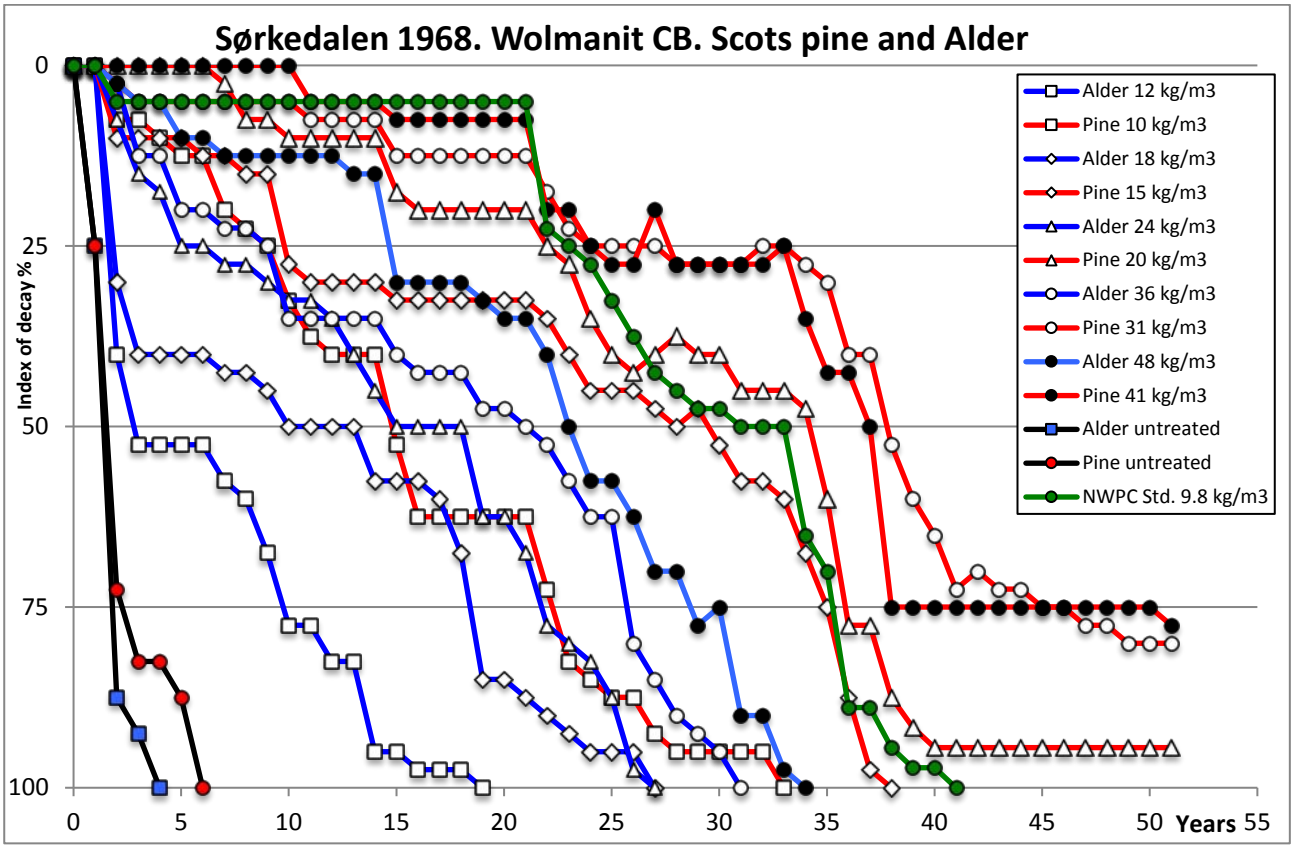
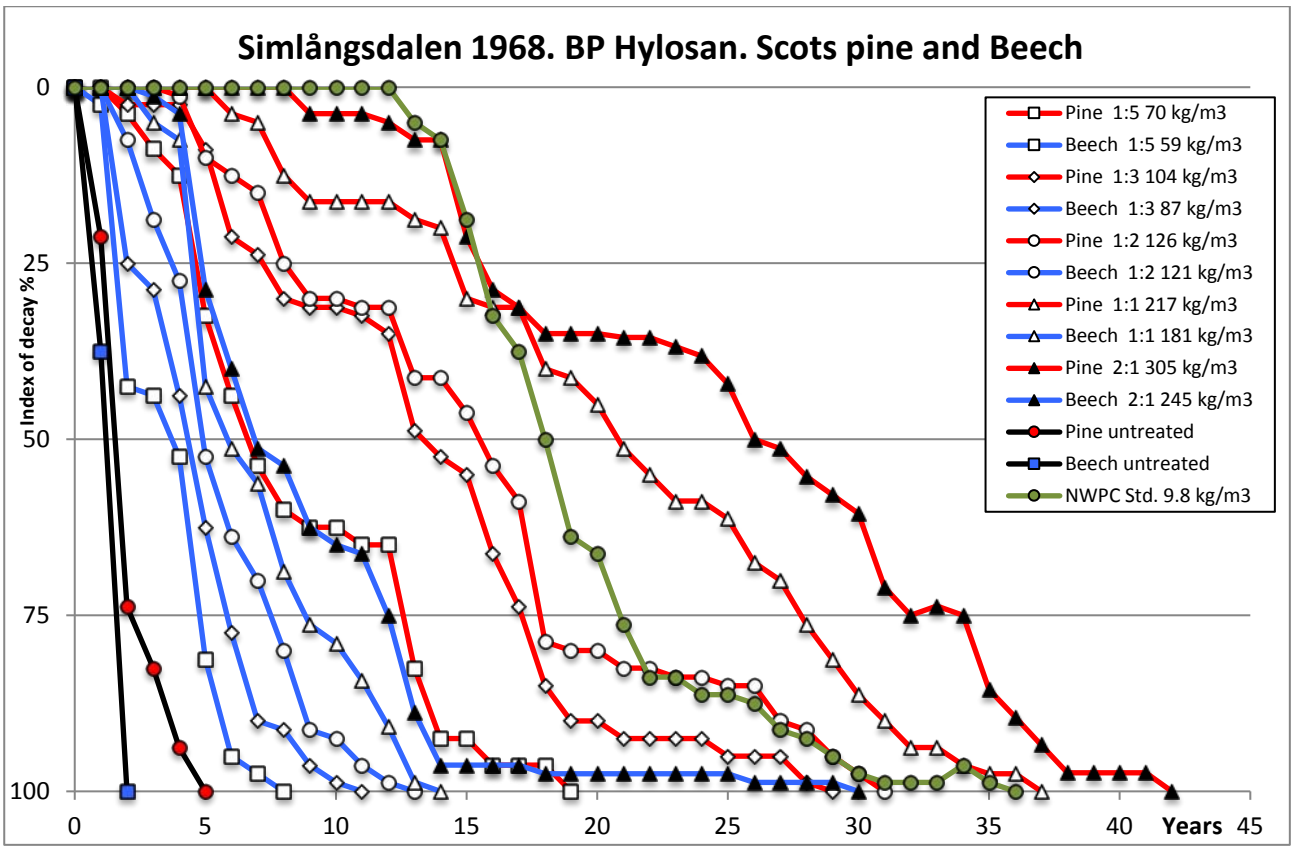


Figure 18. Field trial 1968. Index of decay for stakes of Scots pine, Birch (Vaasa/Viikki) and Alder (Sørkedalen) treated with Wolmanit CB.



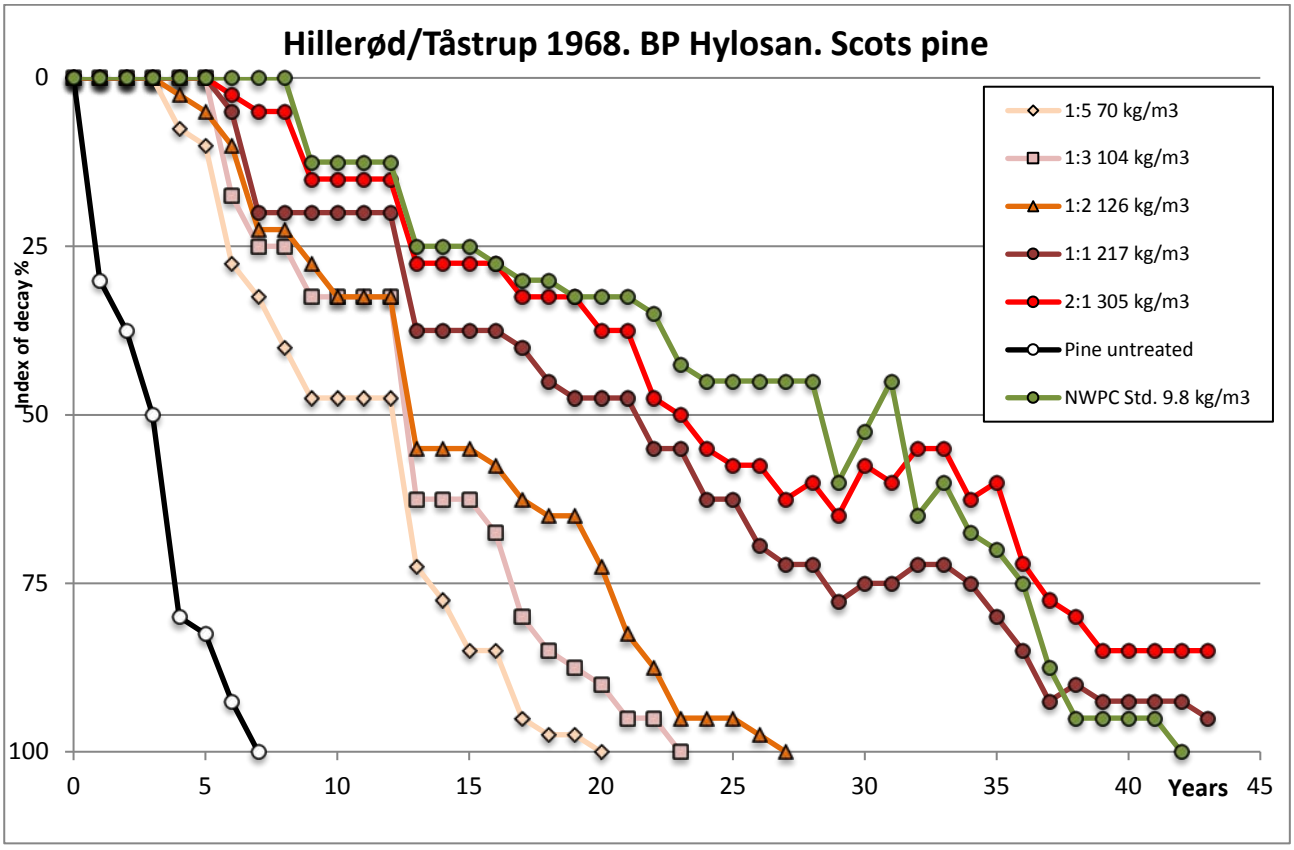
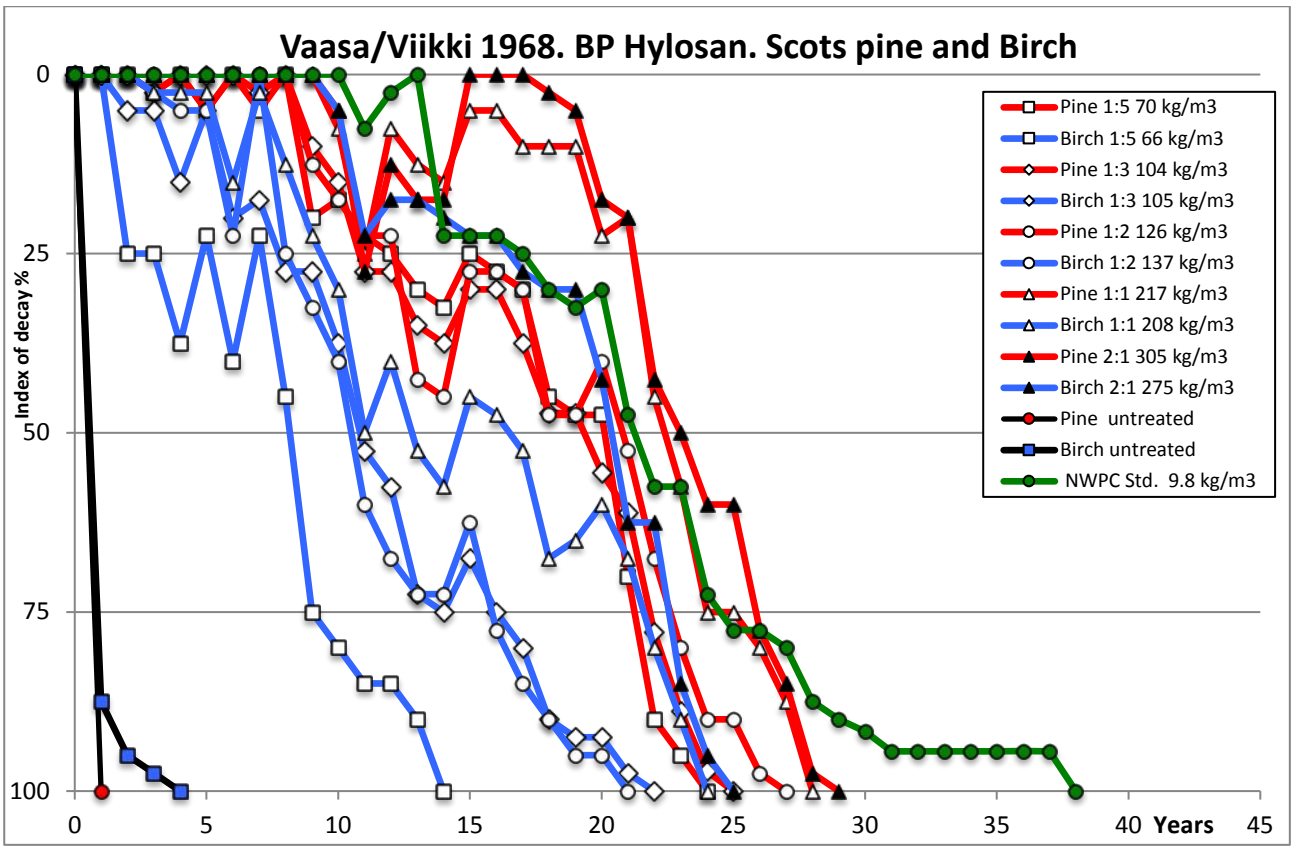


Figure 19. Field trial 1968. Index of decay for stakes of Scots pine and Beech (Simlångsdalen only) treated with BP Hylosan.



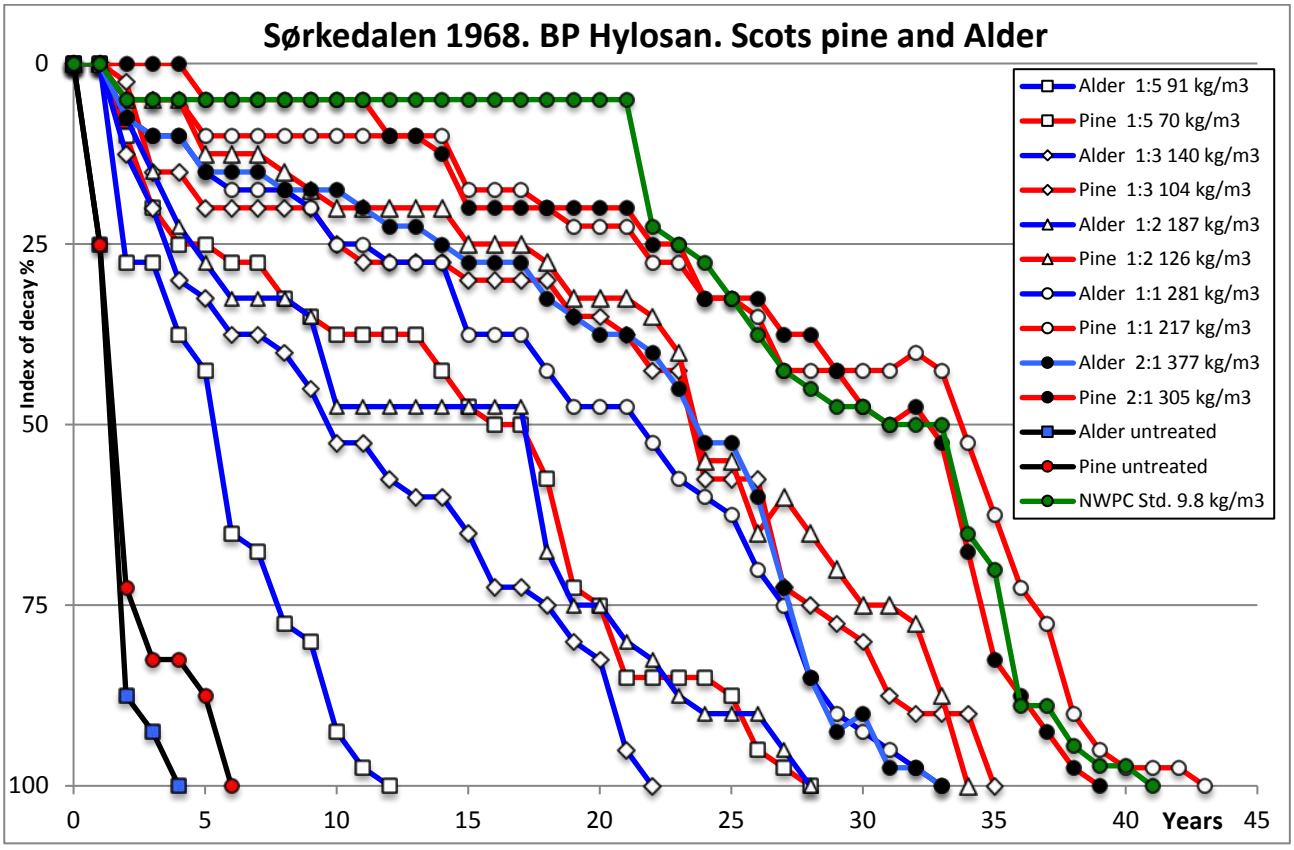
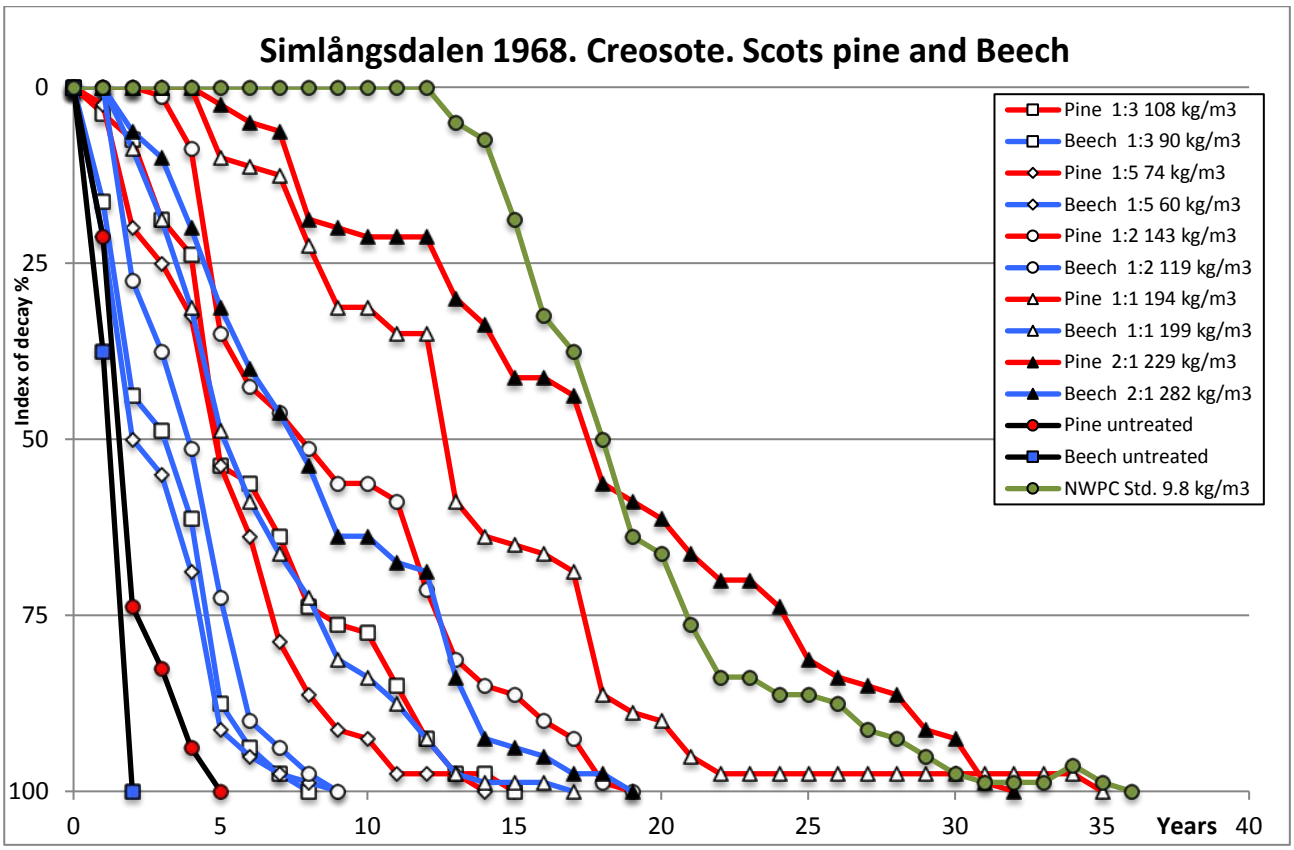


Figure 20. Field trial 1968. Index of decay for stakes of Scots pine, Birch (Vaasa/Viikki) and Alder (Sørkedalen) treated with BP Hylosan.



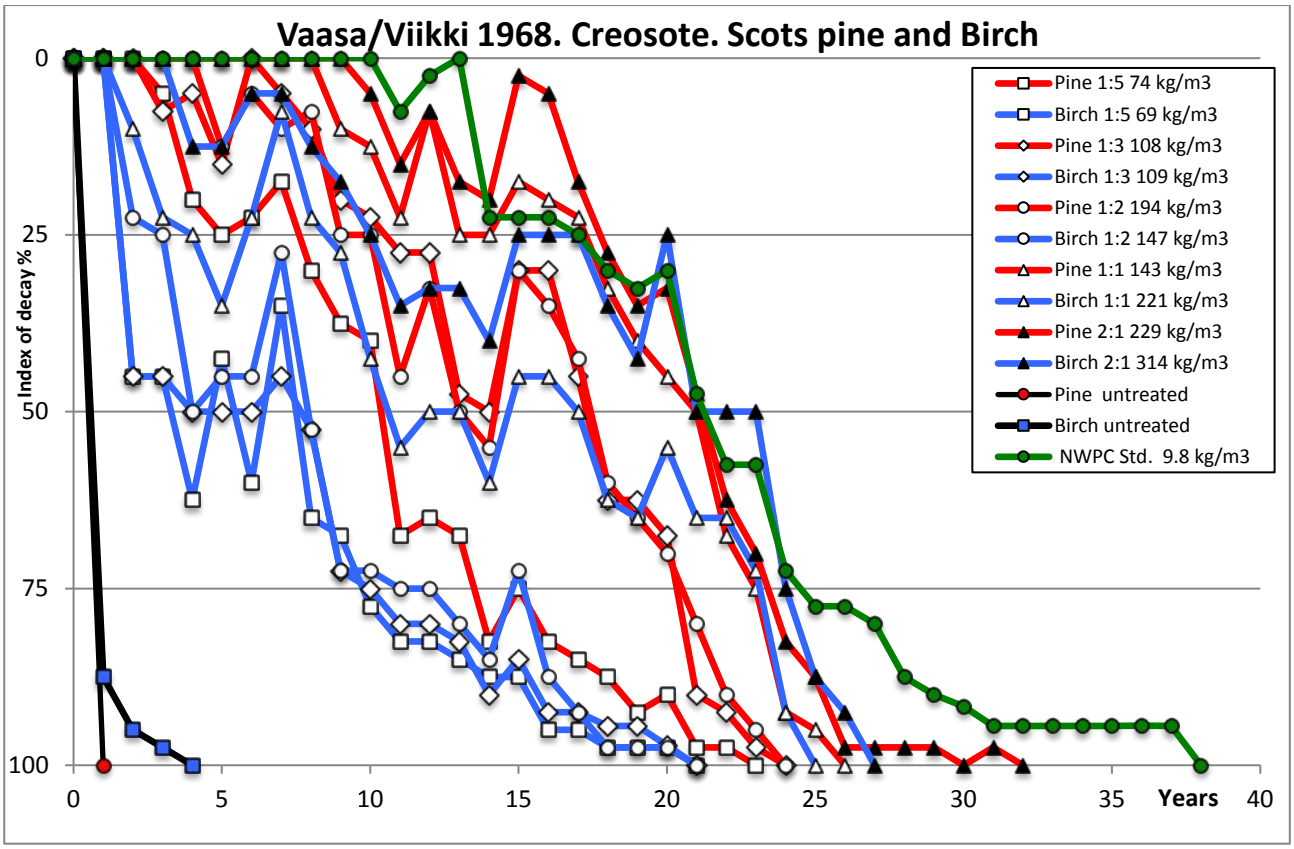


Figure 21. Field trial 1968. Index of decay for stakes of Scots pine and Beech (Simlångsdalen only) treated with Creosote.

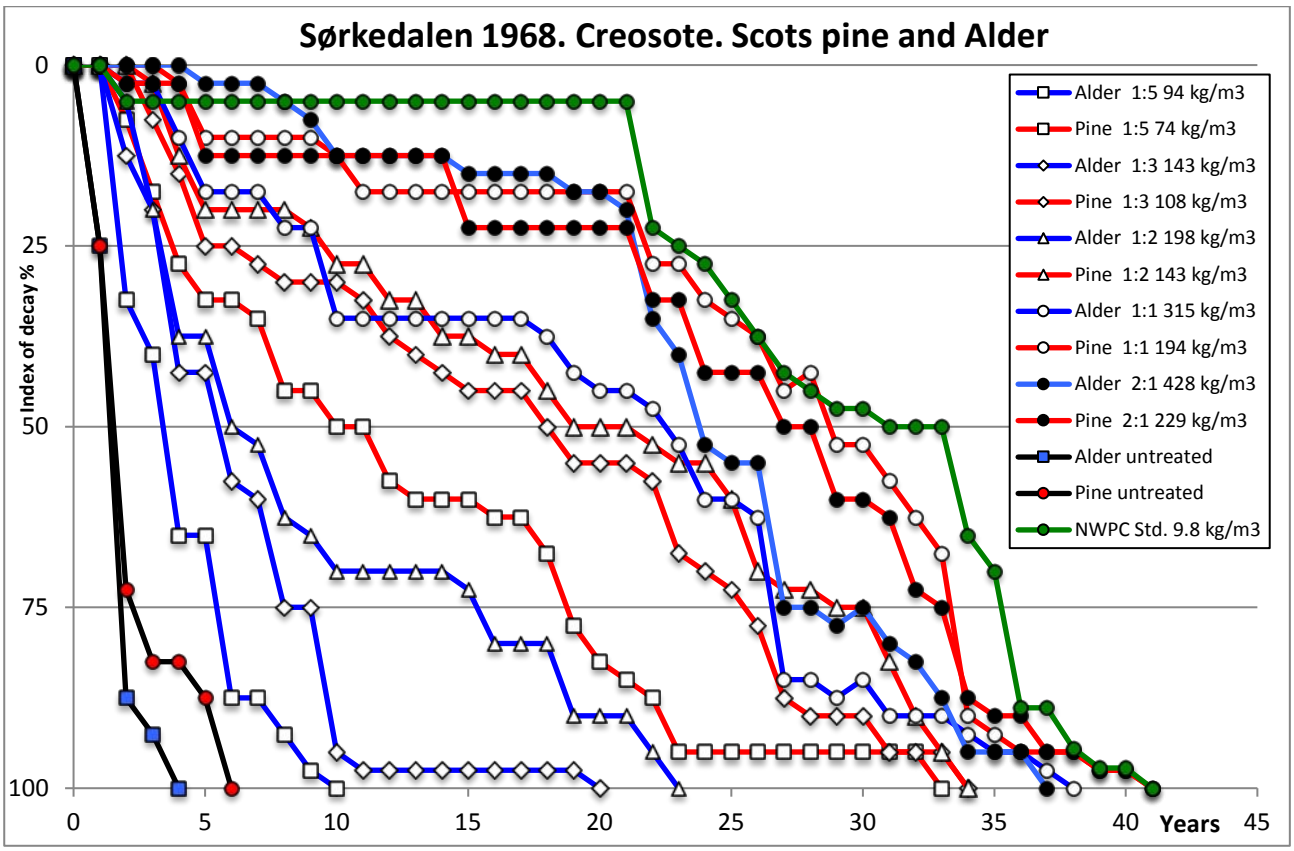
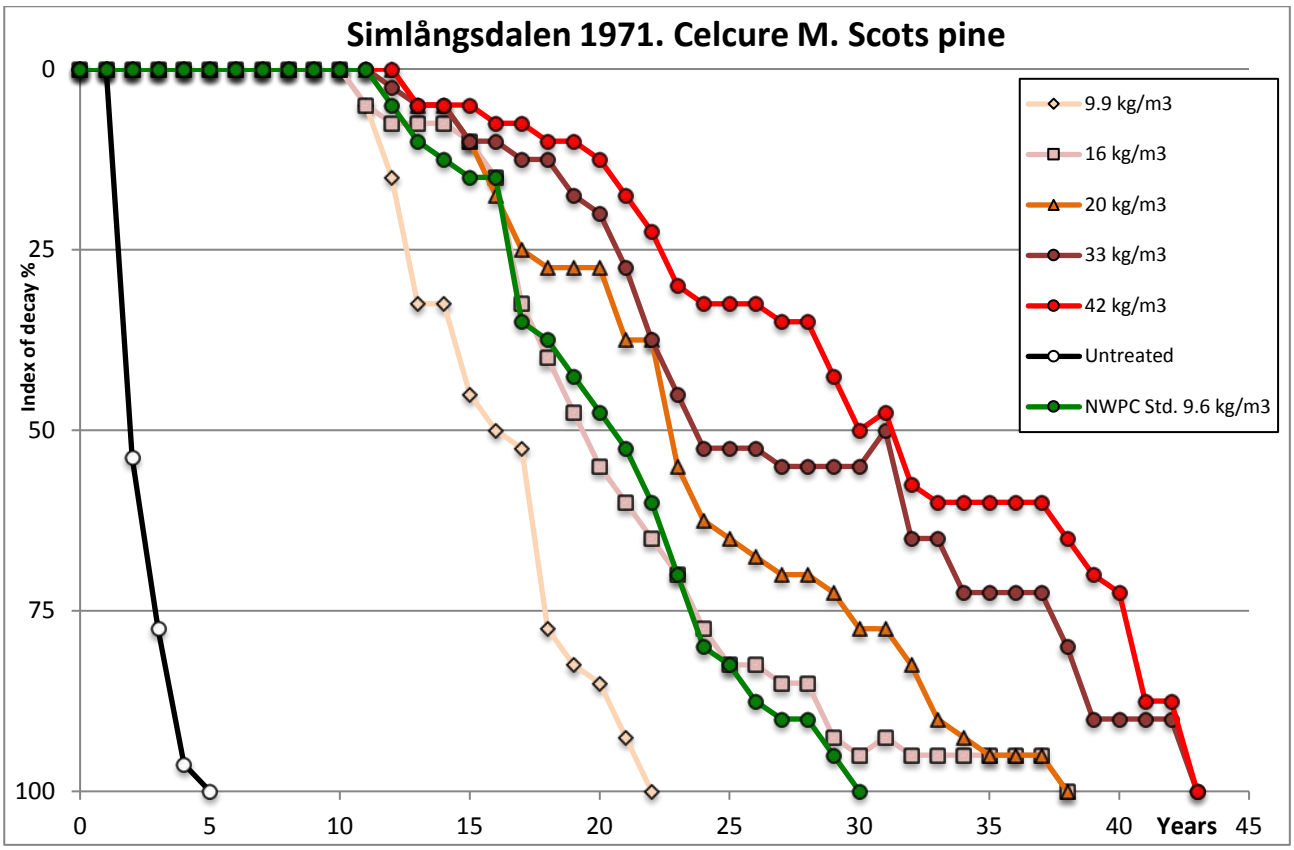


Figure 22. Field trial 1968. Index of decay for stakes of Scots pine, Birch (Vaasa/Viikki) and Alder (Sørkedalen) treated with Creosote.



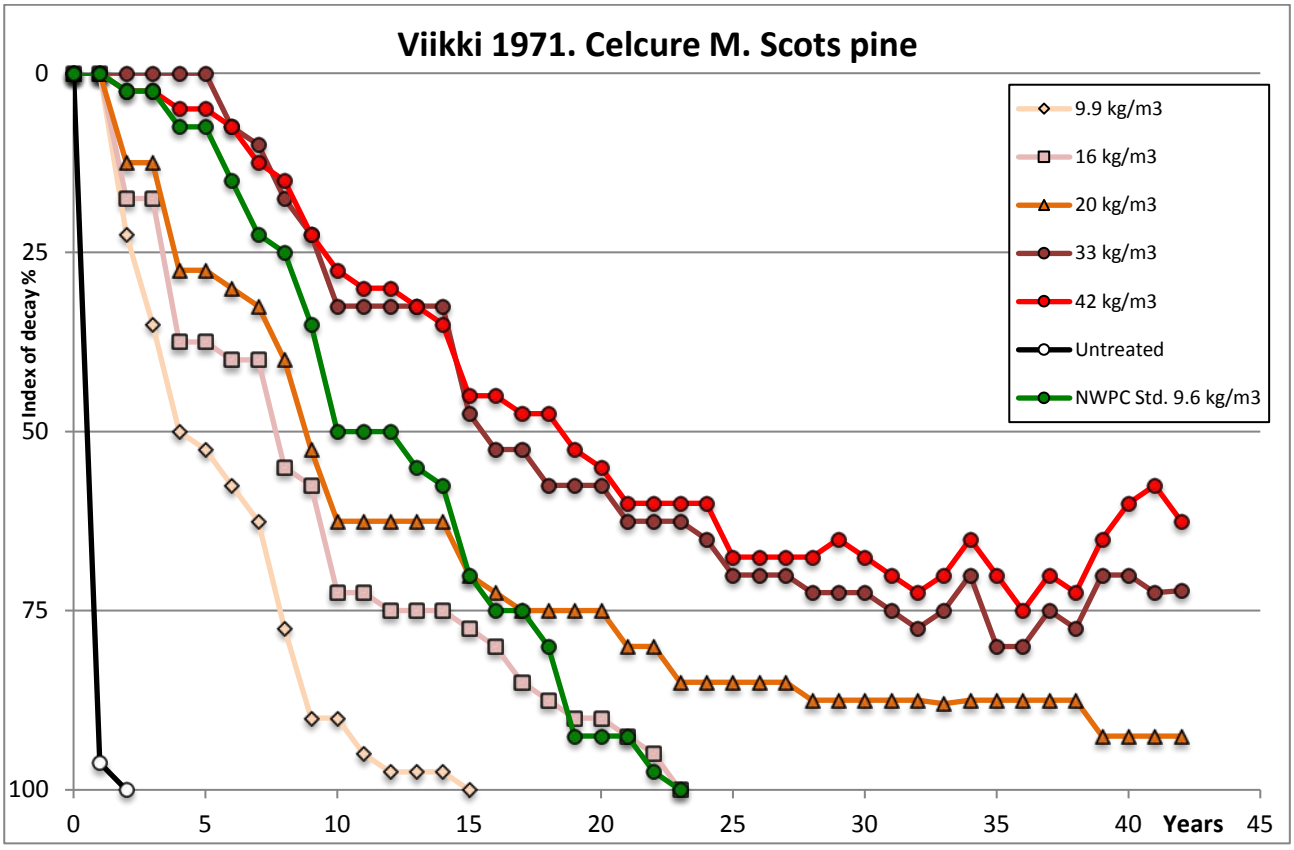
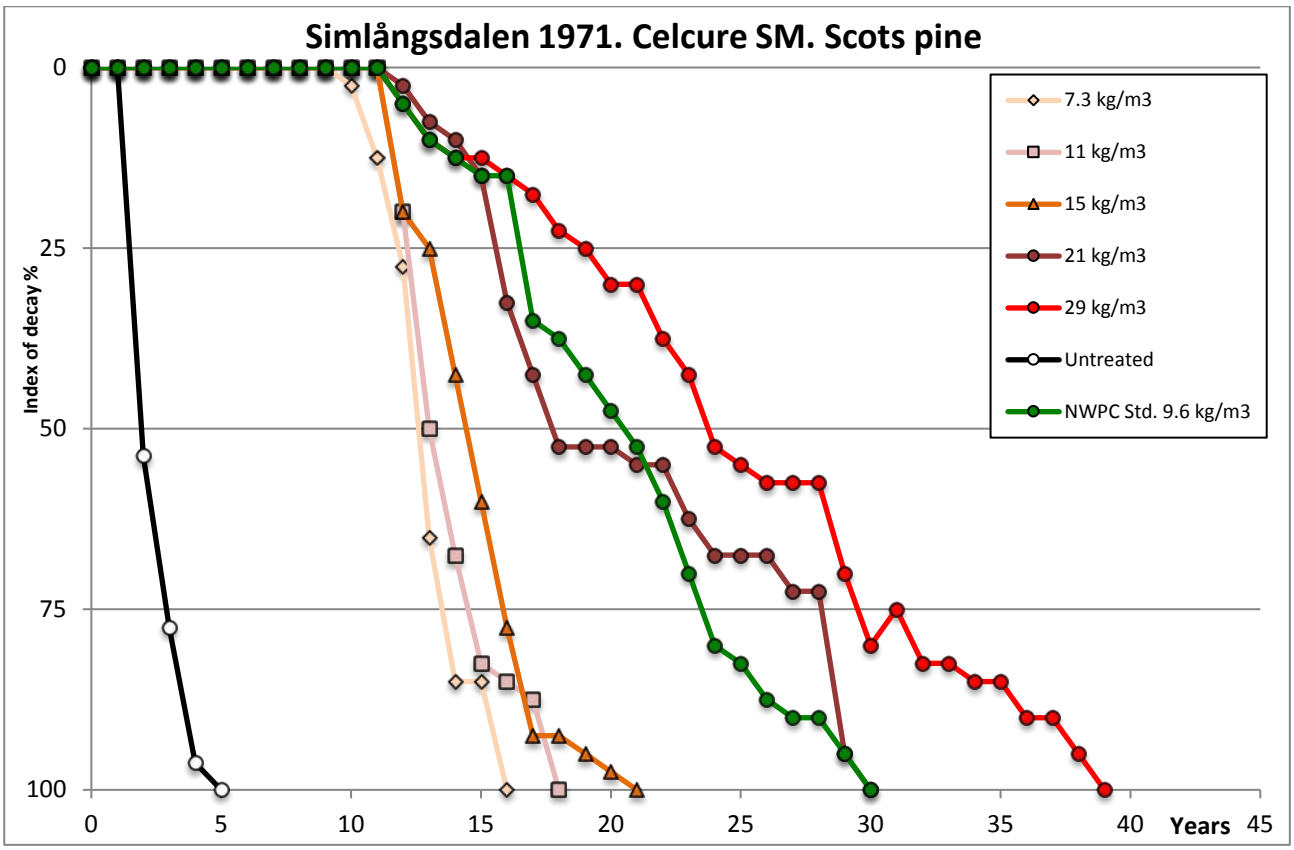


Figure 23. Field trial 1971. Index of decay for stakes of Scots pine treated with Celcure M.



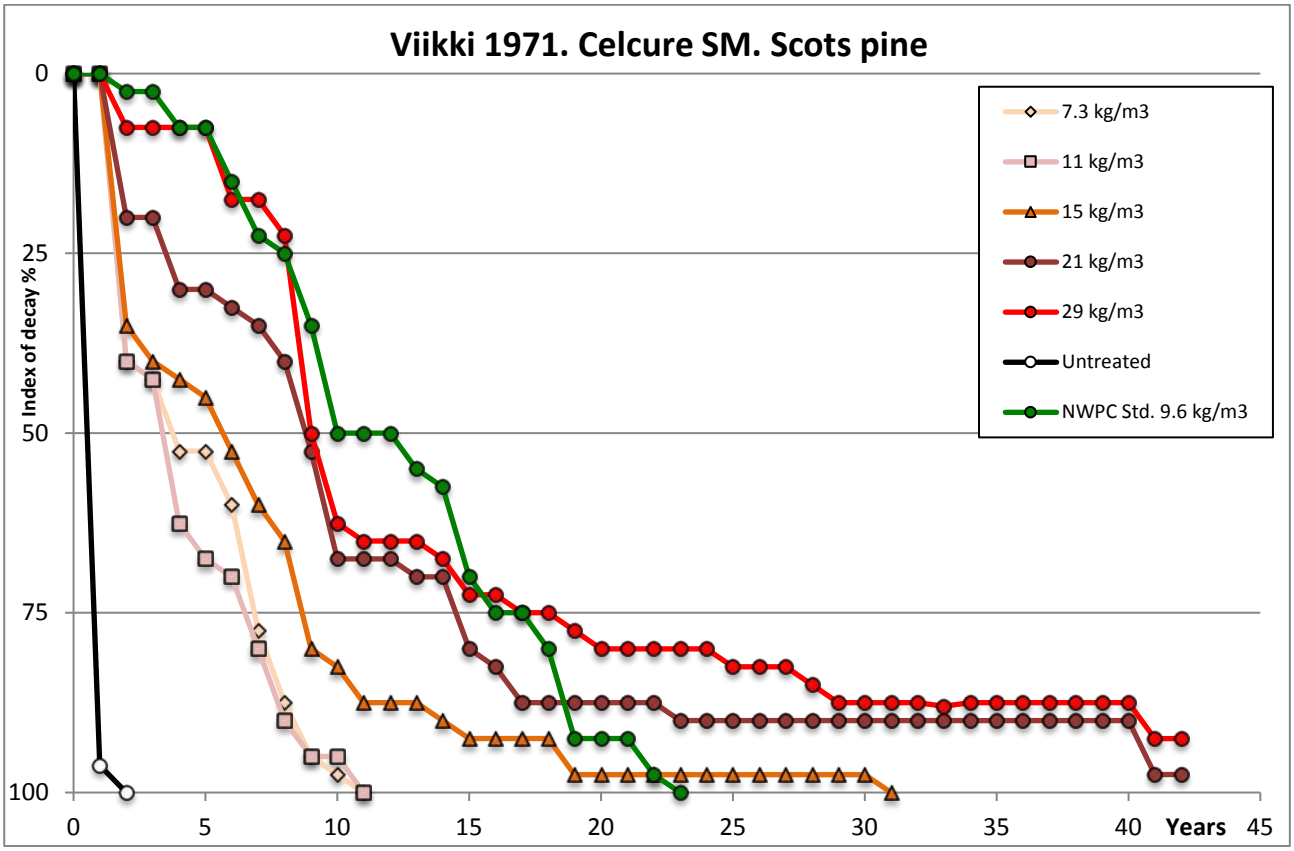
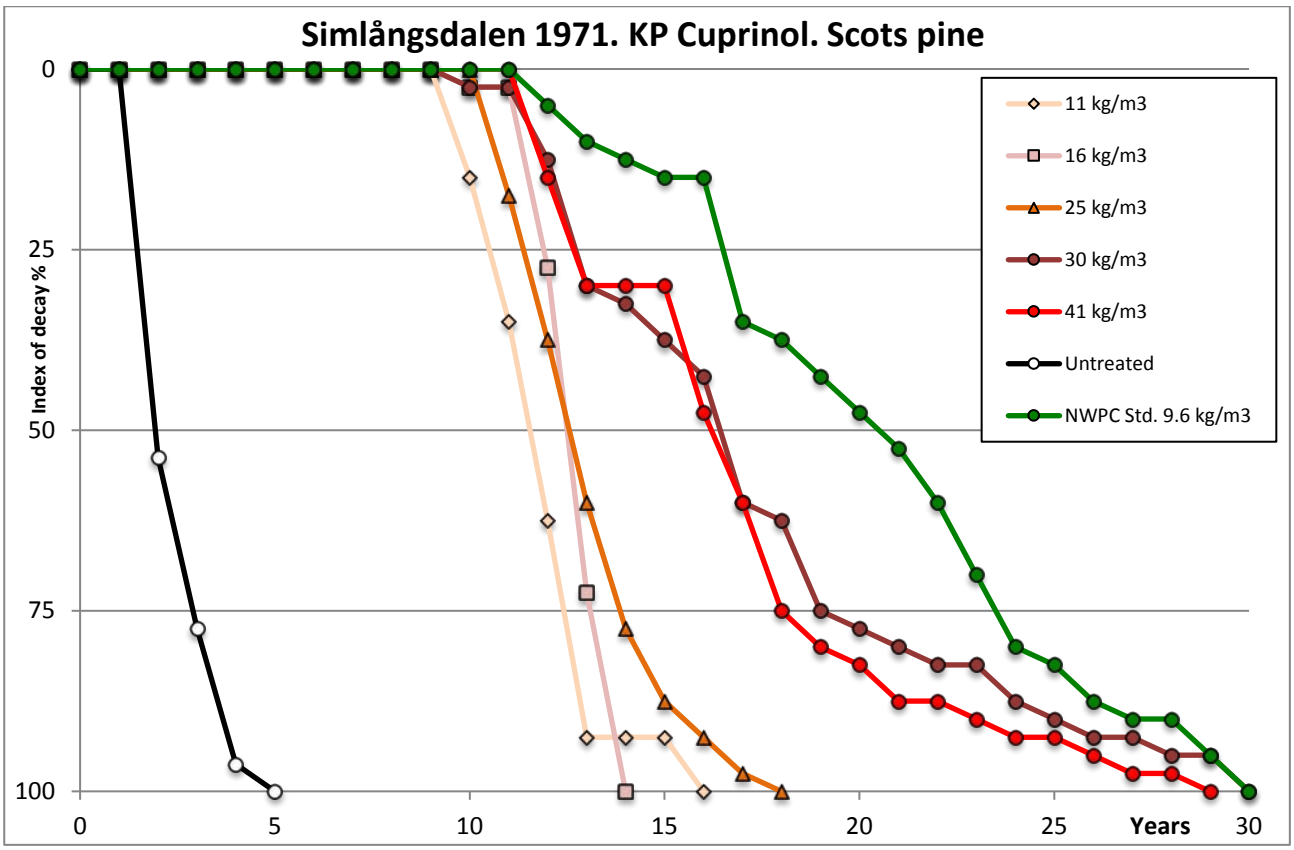


Figure 24. Field trial 1971. Index of decay for stakes of Scots pine treated with Celcure SM.



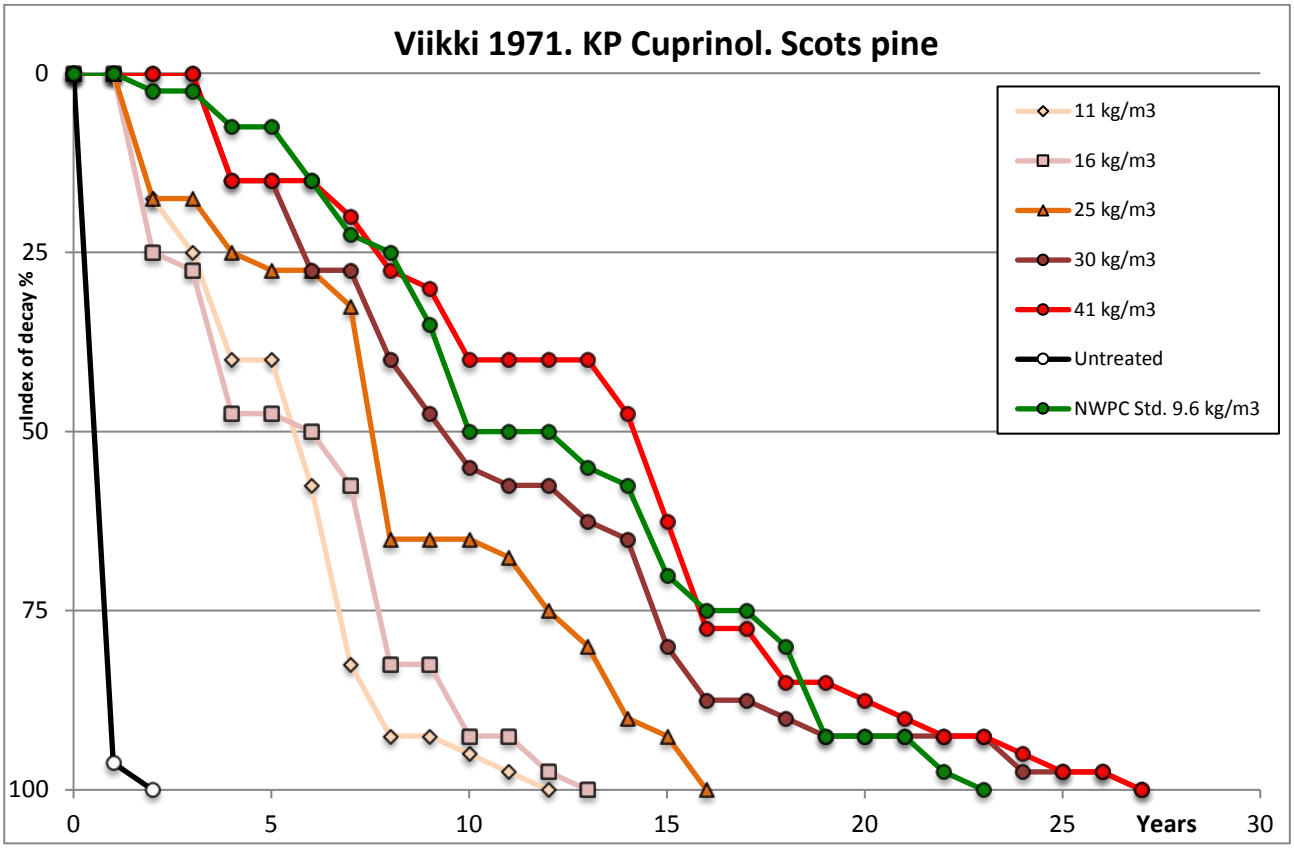
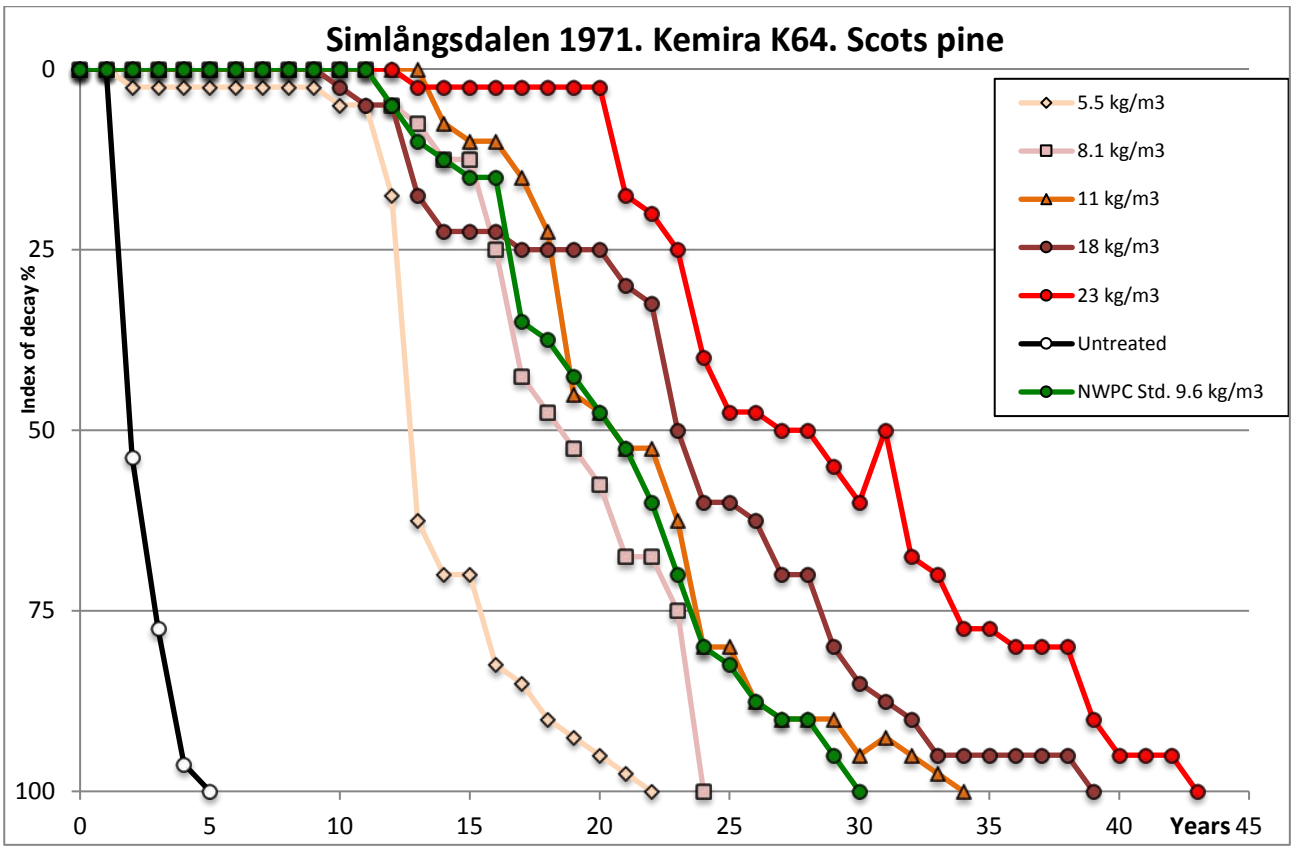


Figure 25. Field trial 1971. Index of decay for stakes of Scots pine treated with KP Cuprinol.



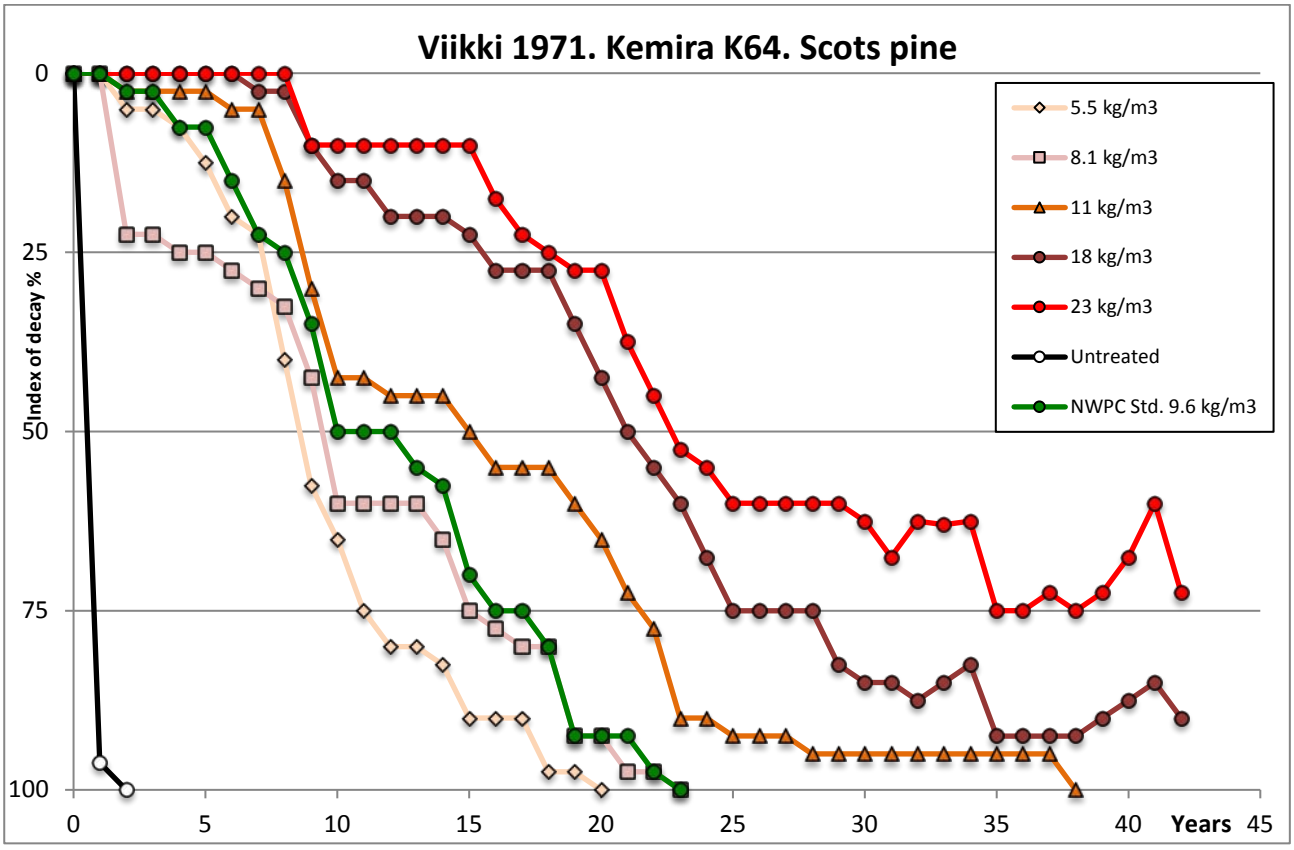
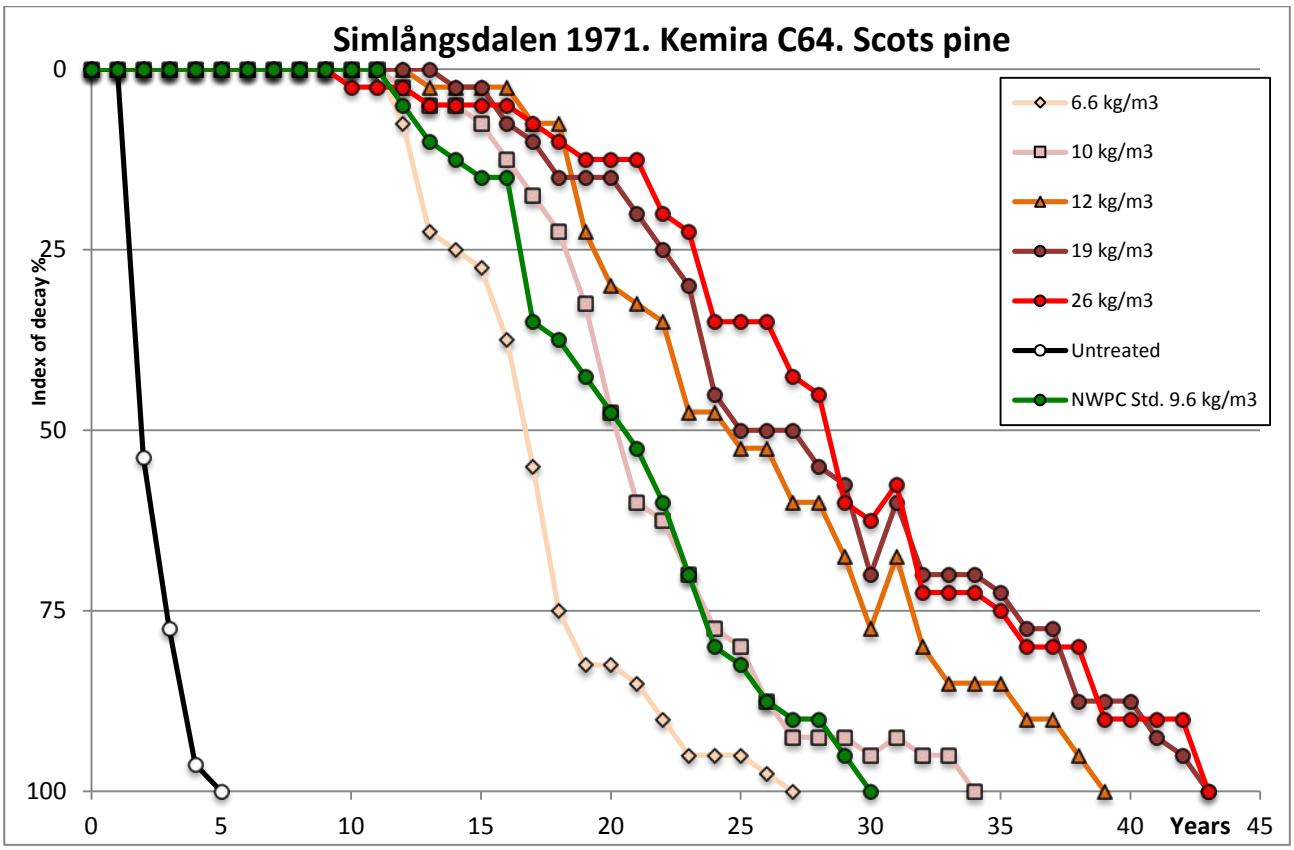


Figure 26. Field trial 1971. Index of decay for stakes of Scots pine treated with Kemira K64.



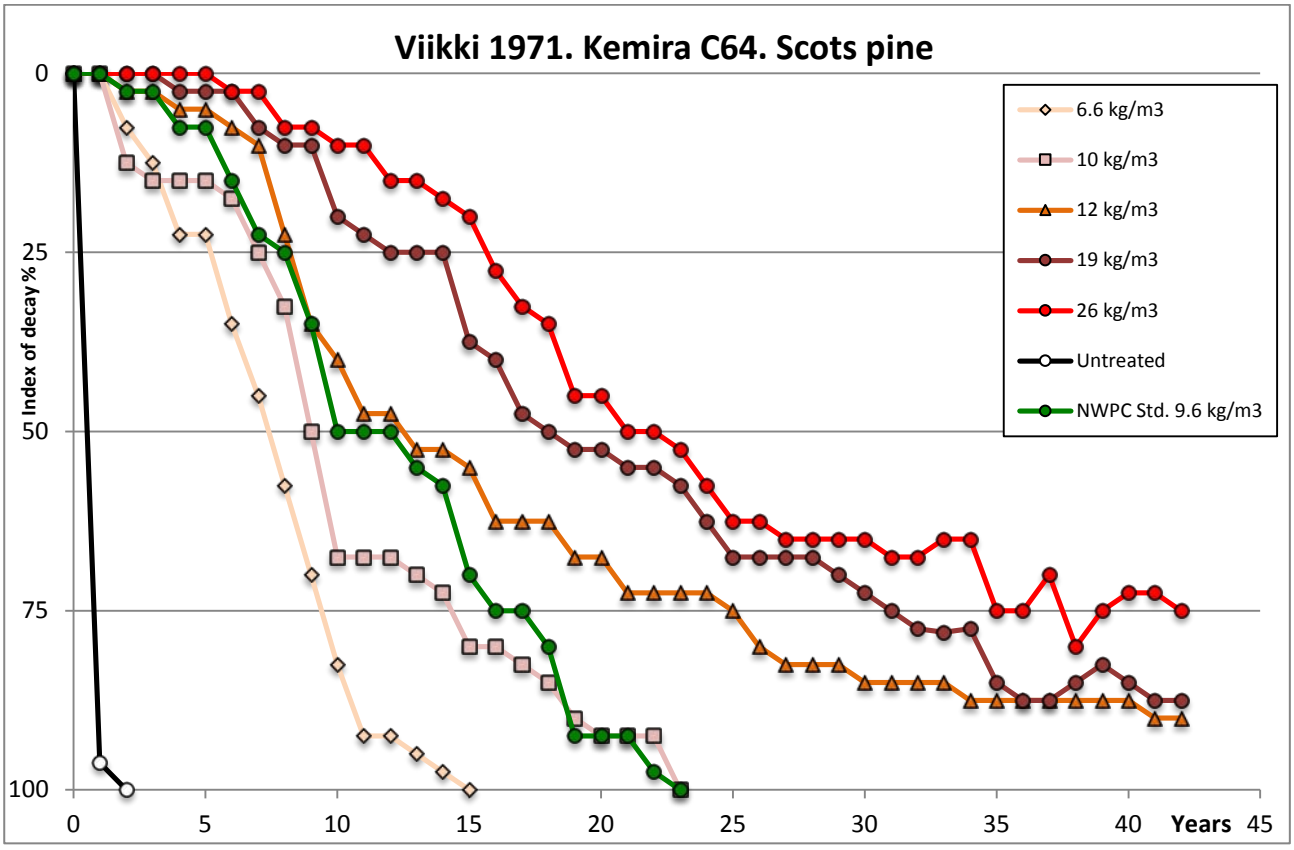
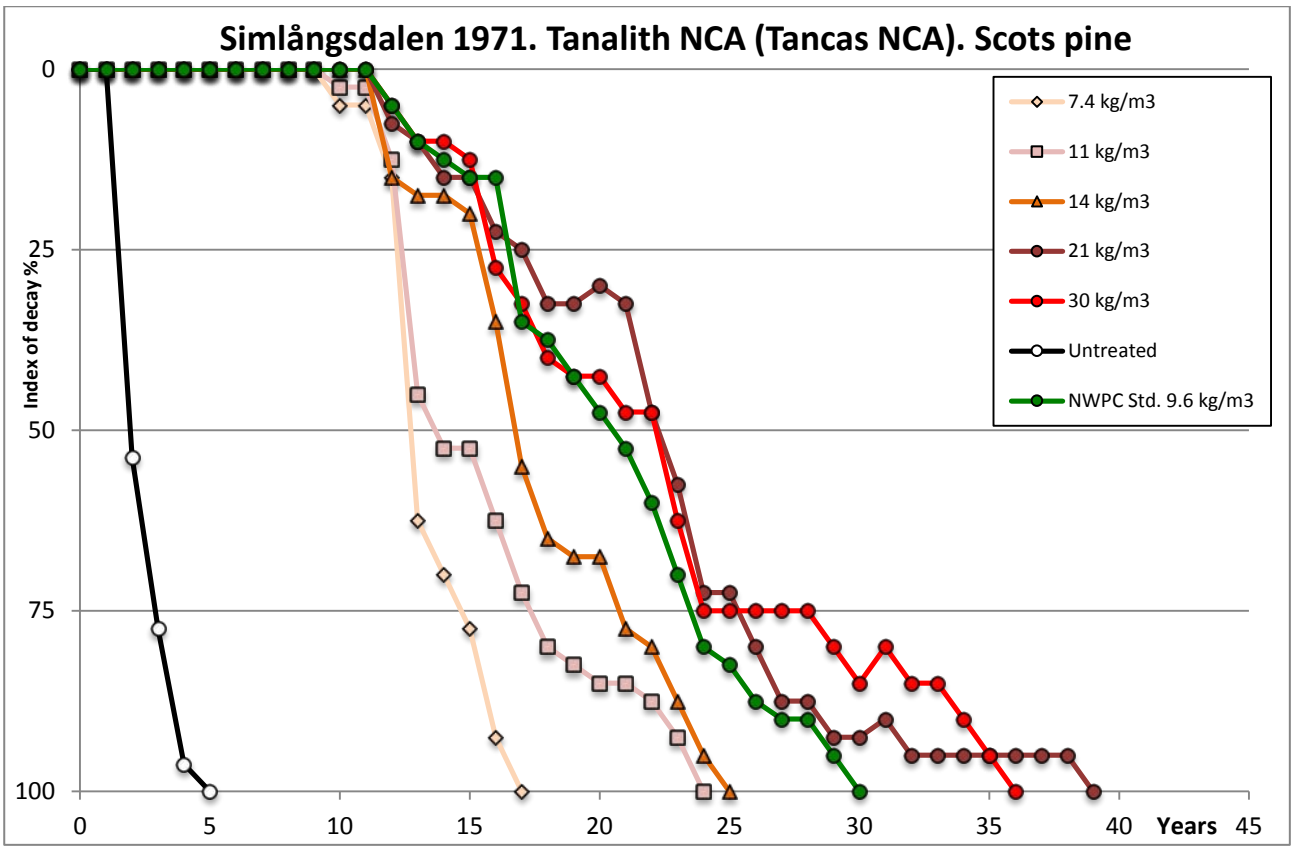


Figure 27. Field trial 1971. Index of decay for stakes of Scots pine treated with Kemira C64.



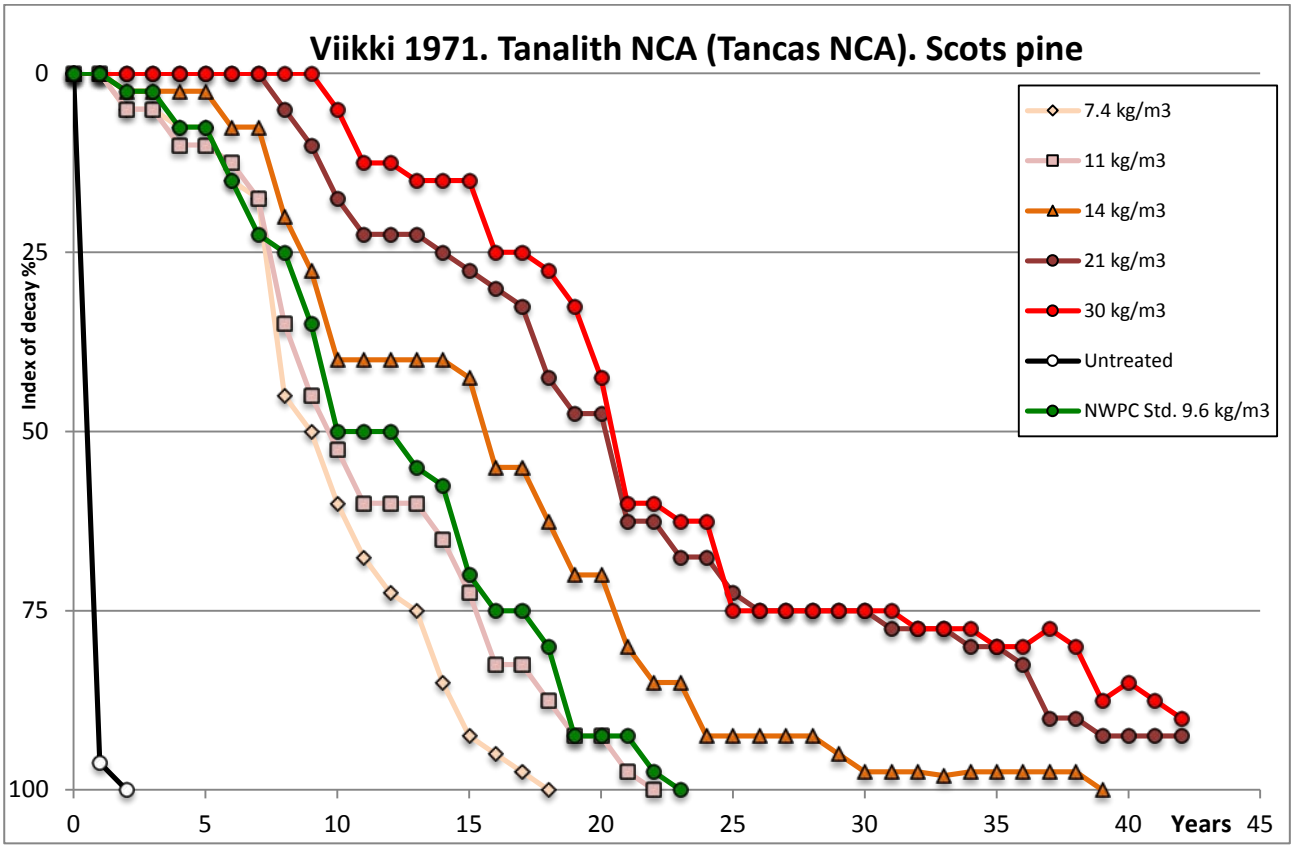
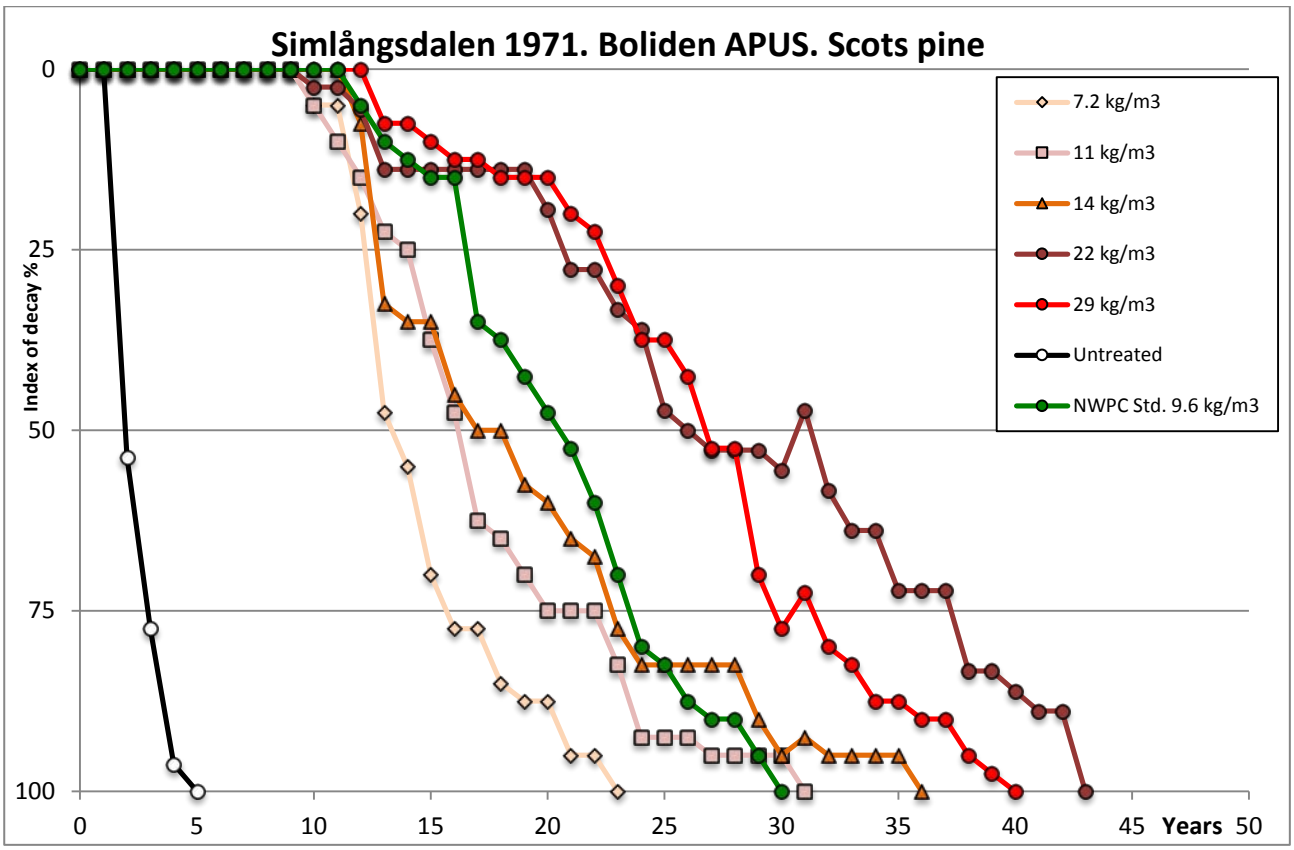


Figure 28. Field trial 1971. Index of decay for stakes of Scots pine treated with Tanalith NCA (Tancas NCA).



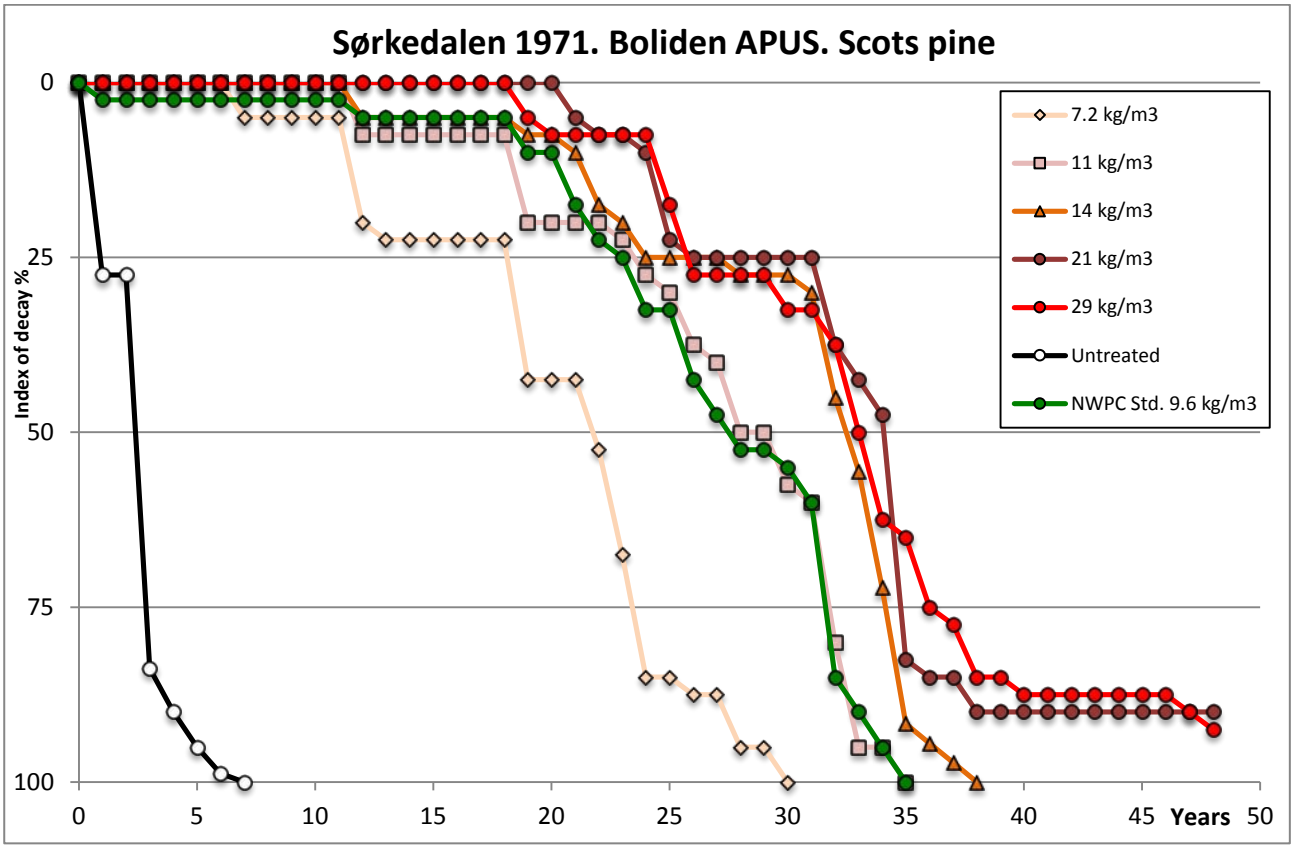
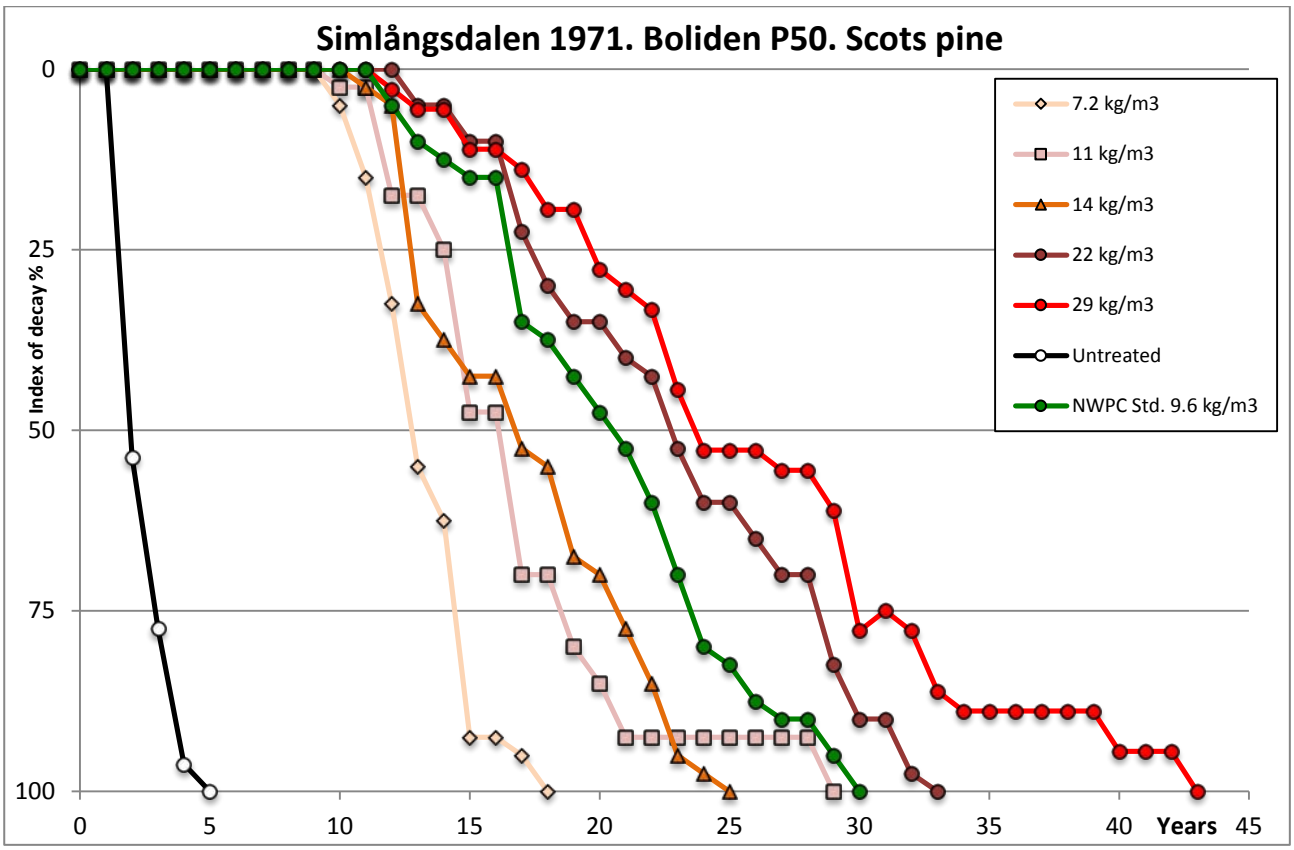


Figure 29. Field trial 1971. Index of decay for stakes of Scots pine treated with Boliden APUS.



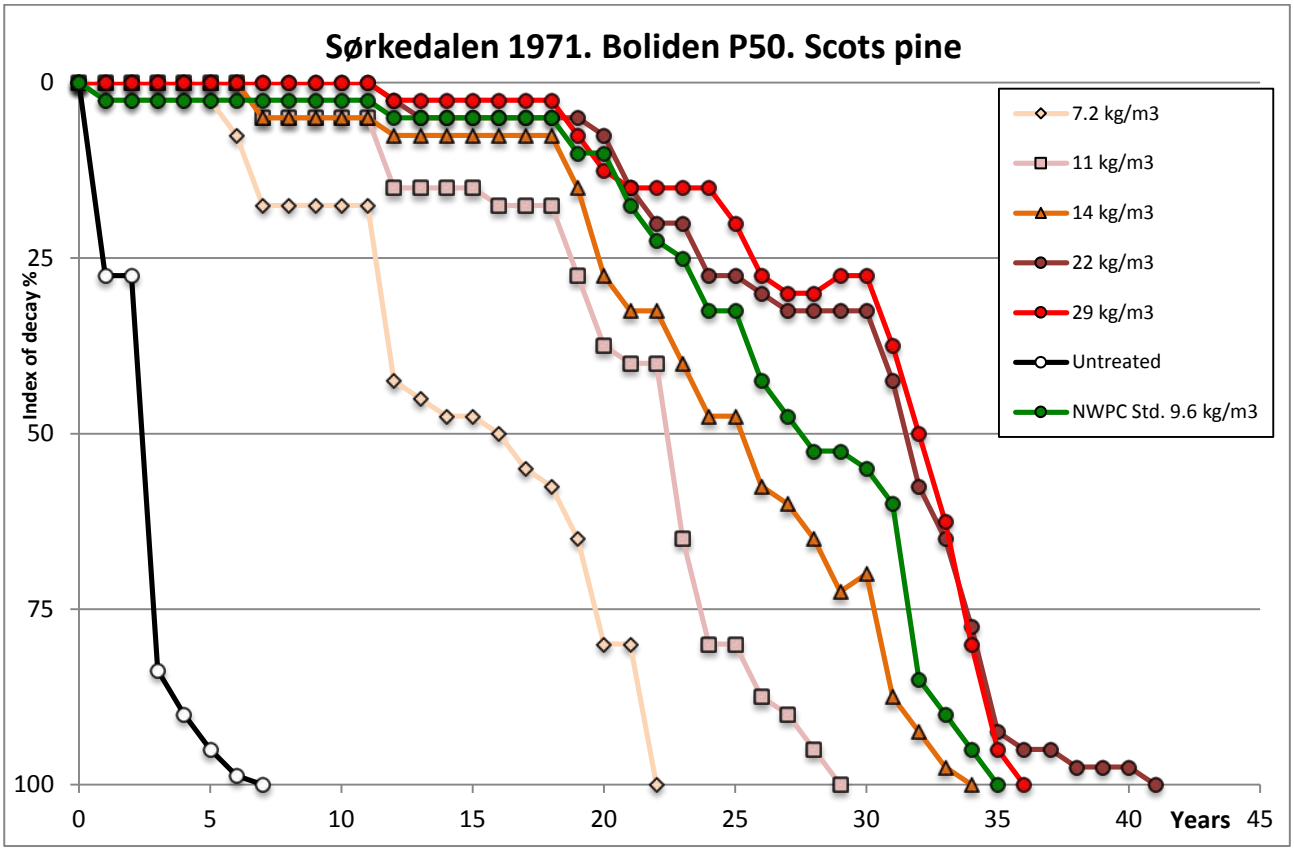
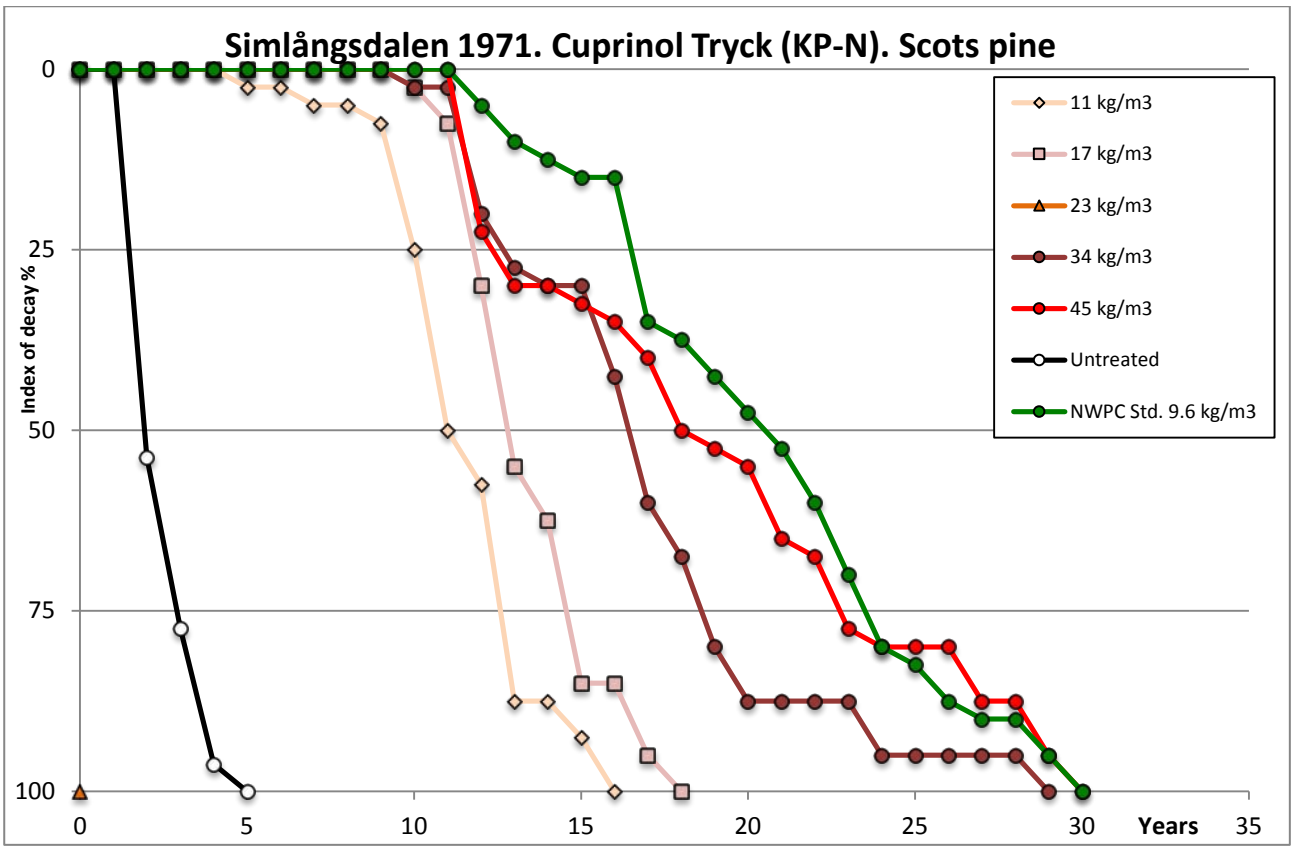


Figure 30. Field trial 1971. Index of decay for stakes of Scots pine treated with Boliden P50.



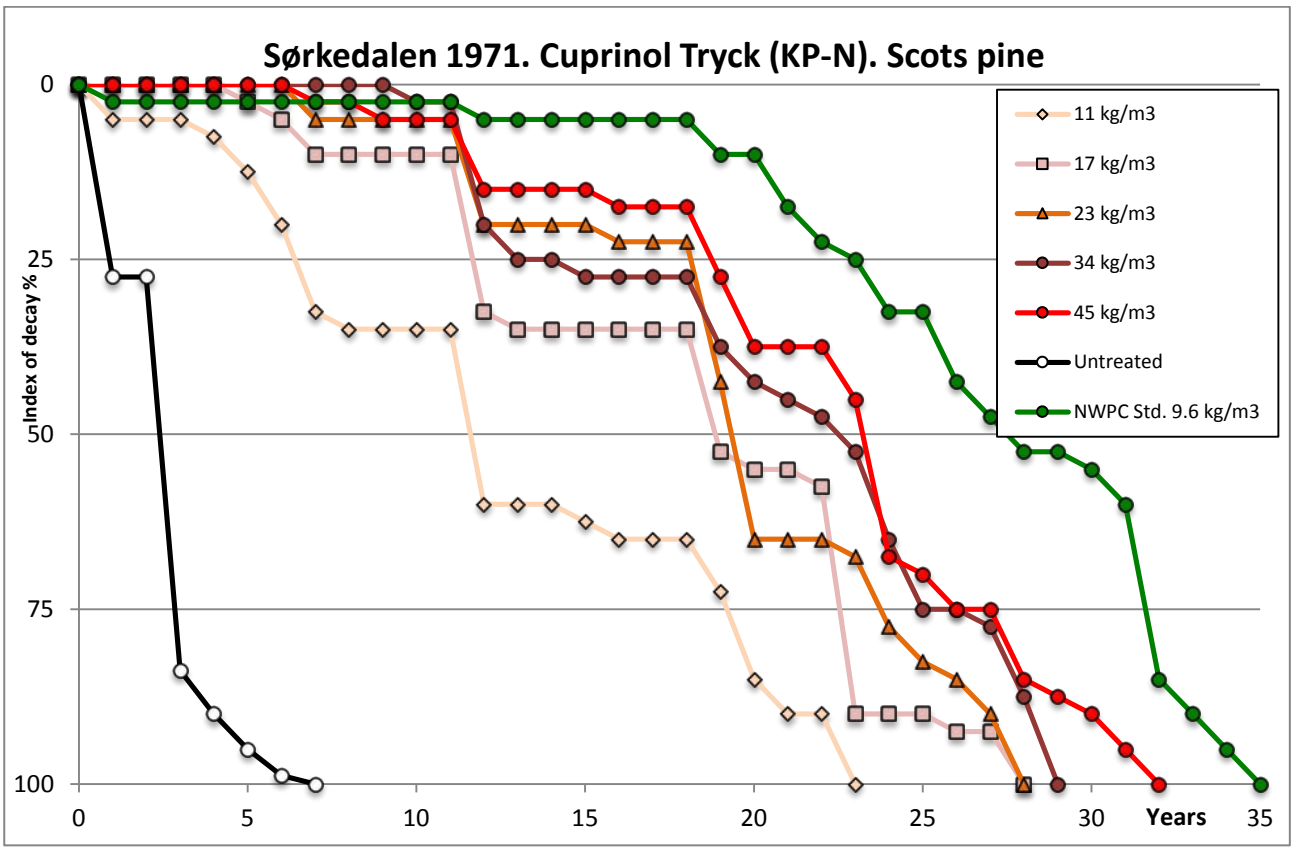
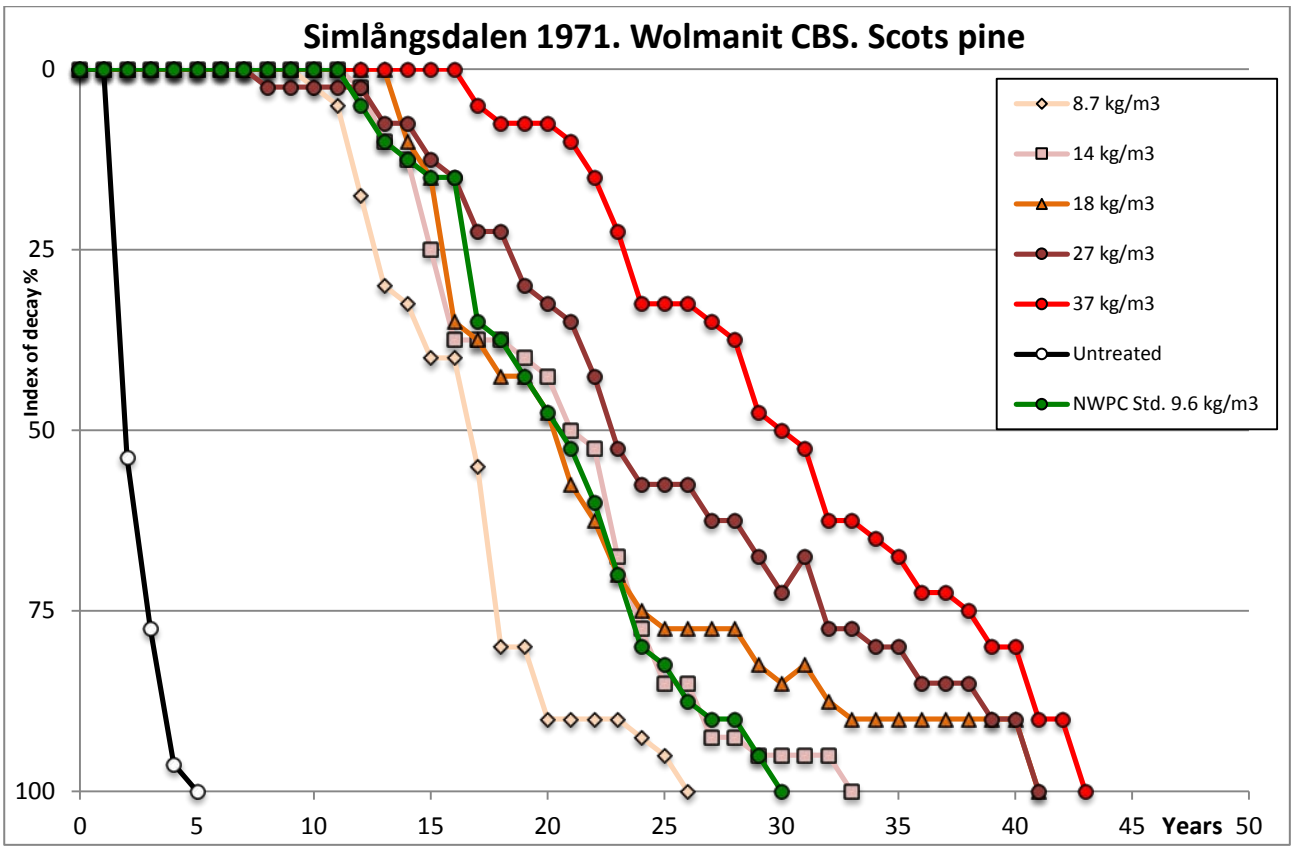


Figure 31. Field trial 1971. Index of decay for stakes of Scots pine treated with Cuprinol Tryck (KP-N).



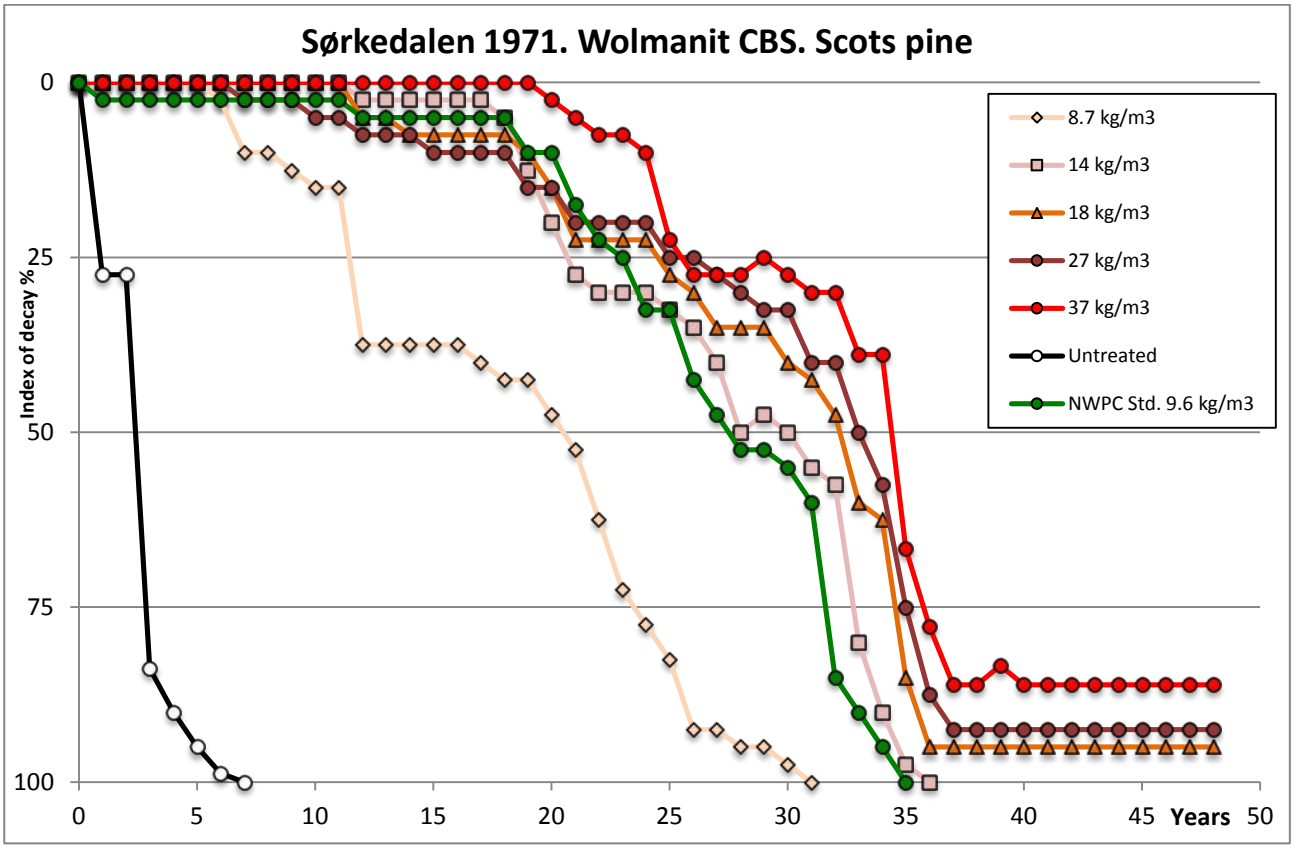
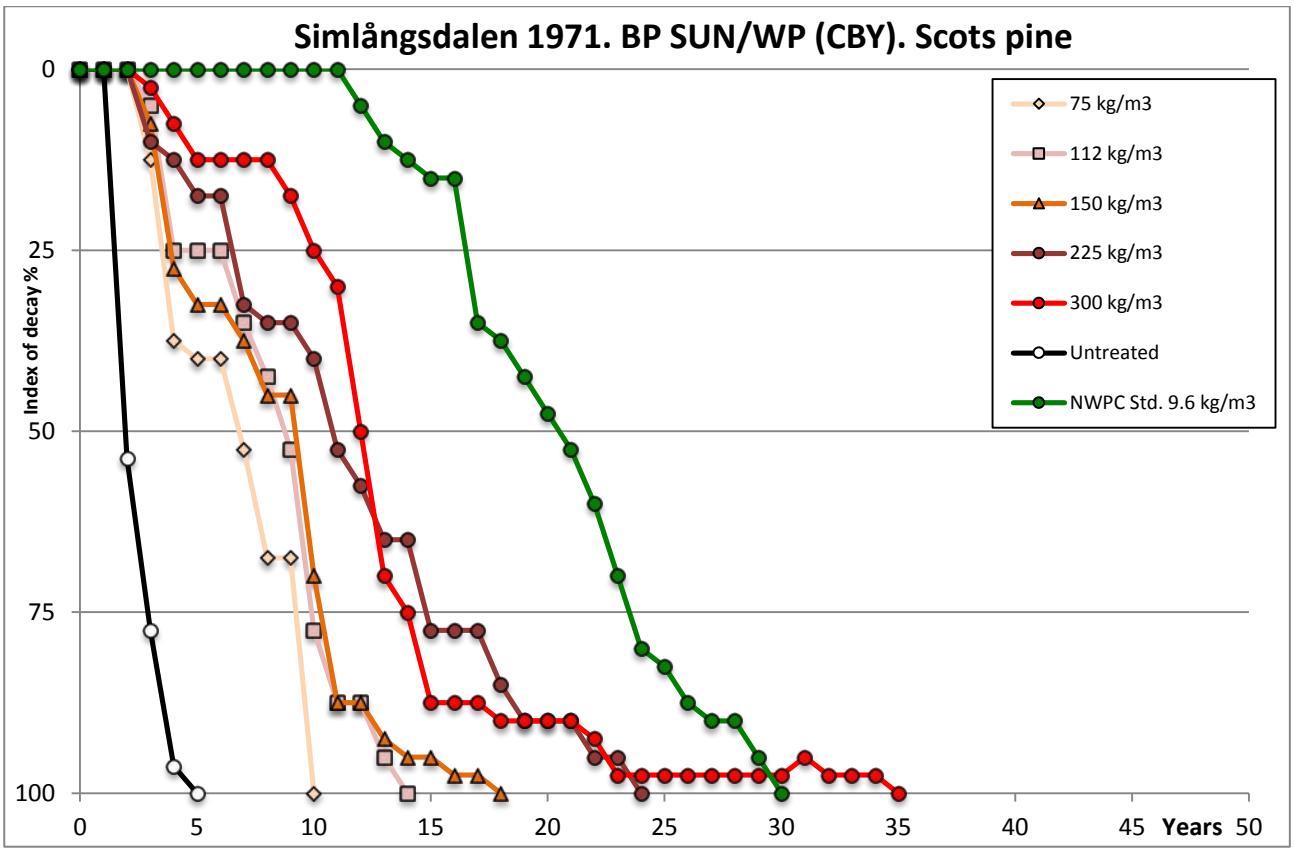


Figure 32. Field trial 1971. Index of decay for stakes of Scots pine treated with Wolmanit CBS.



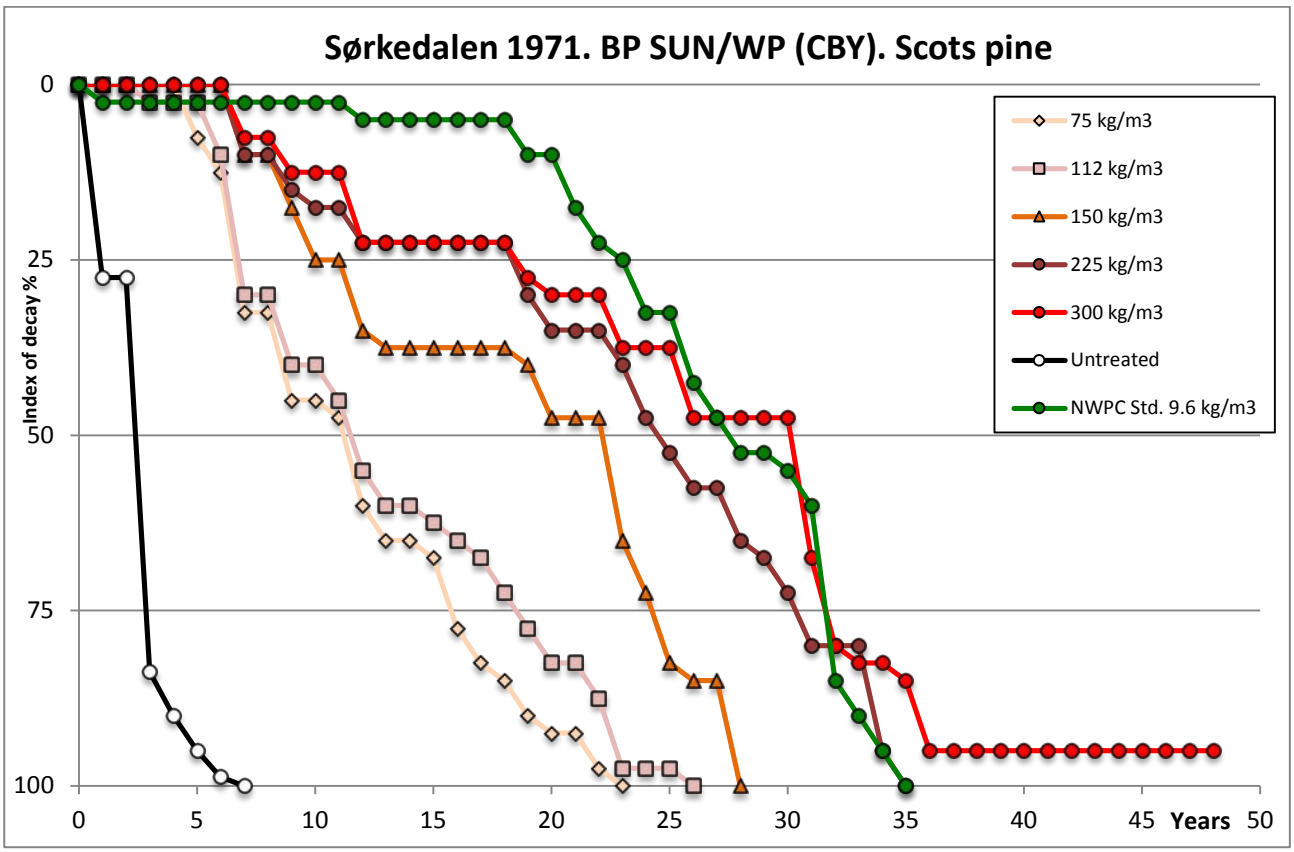
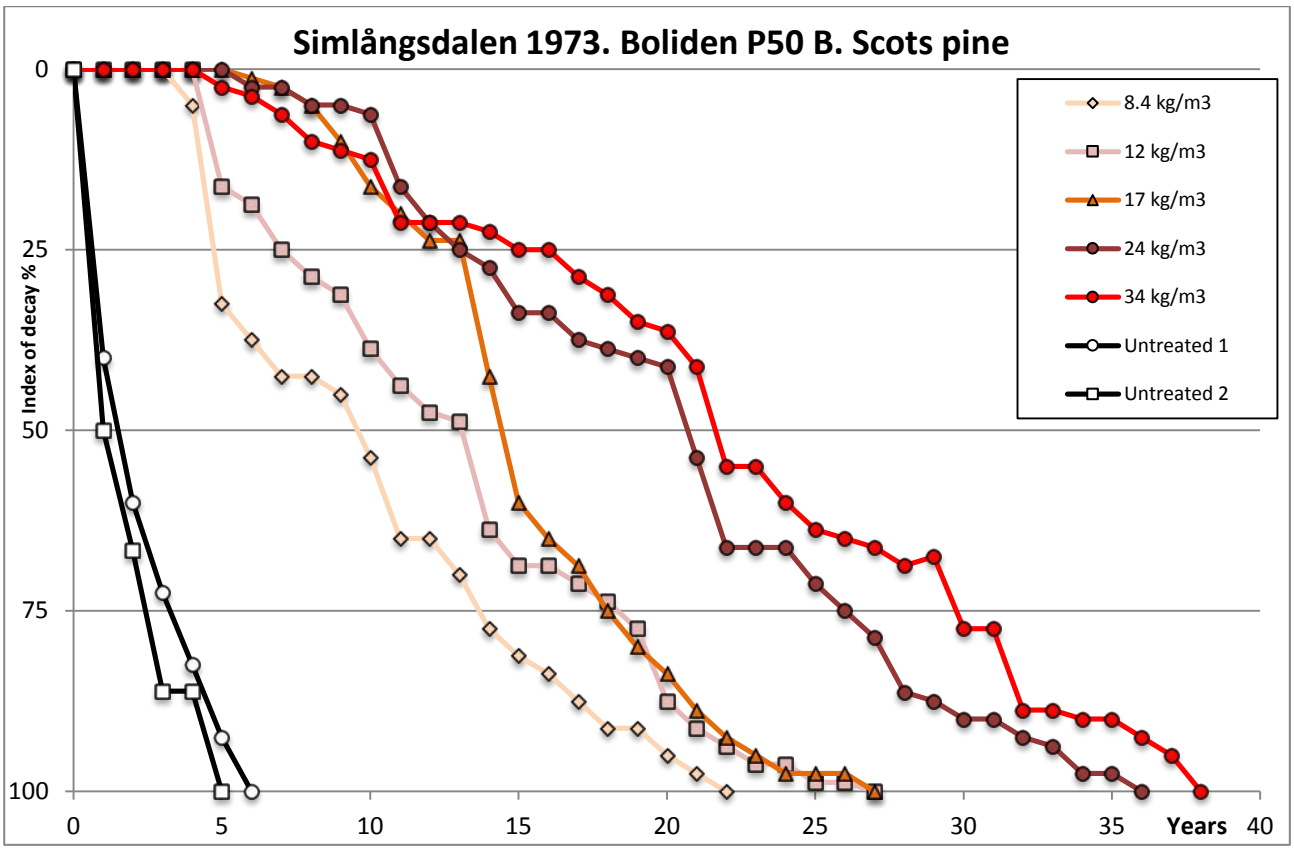


Figure 33. Field trial 1971. Index of decay for stakes of Scots pine treated with BP SUN/WP (CBY).



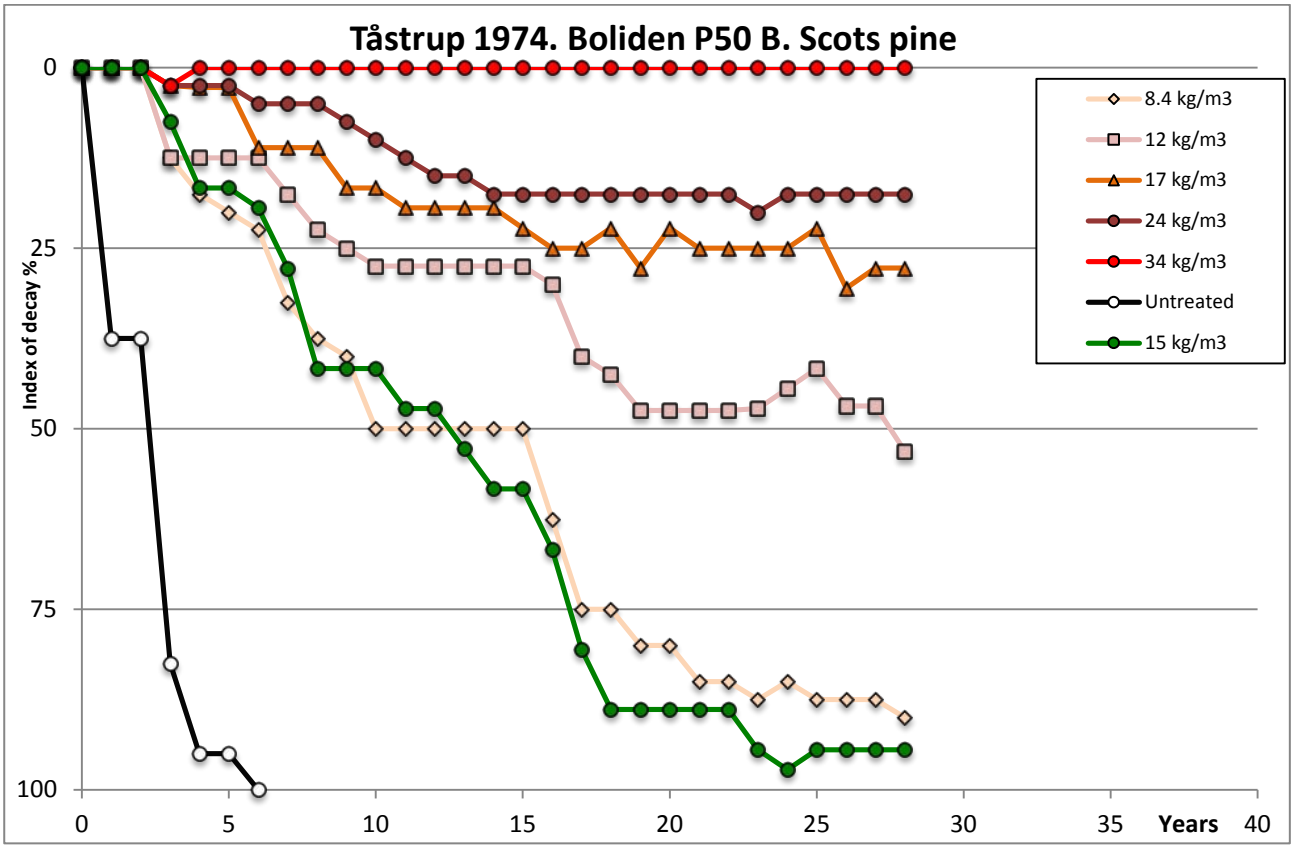
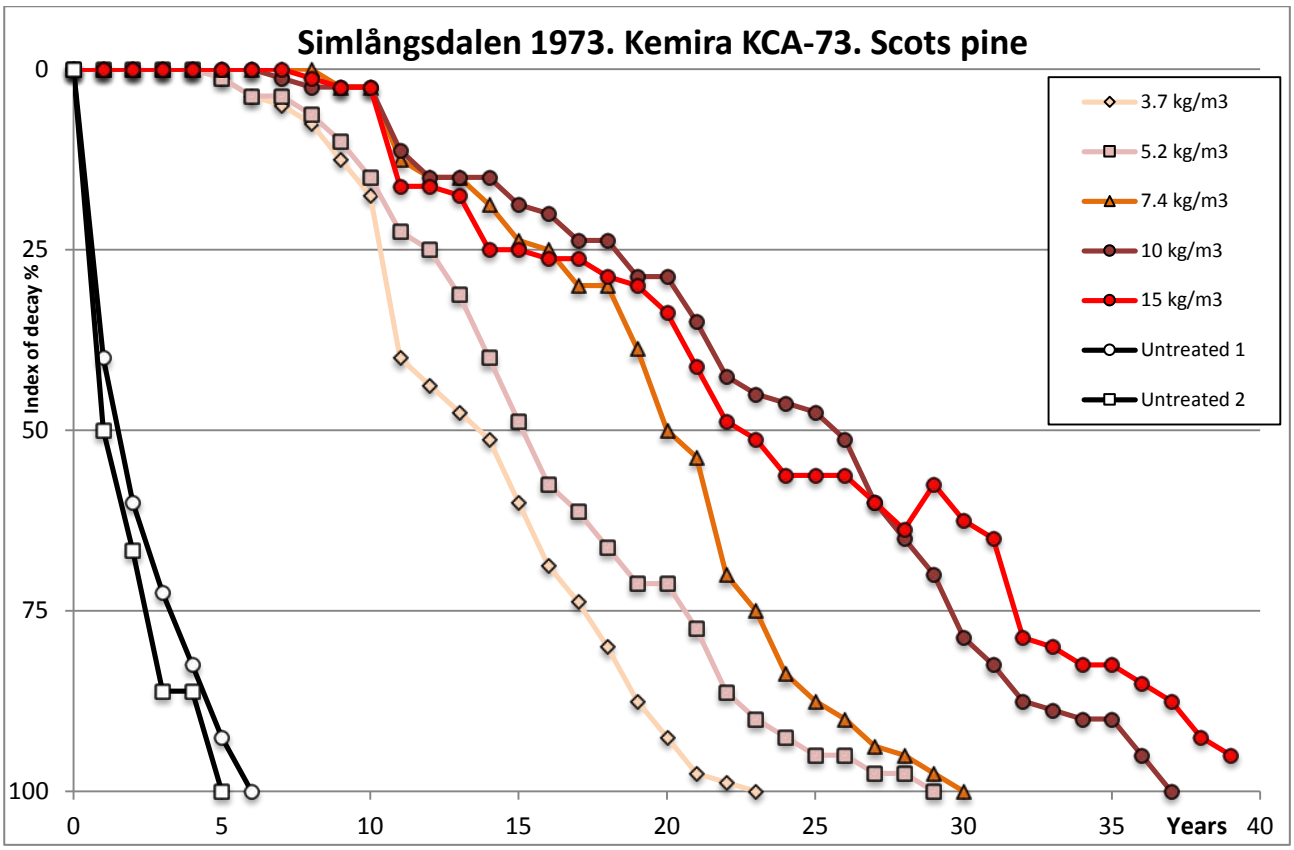


Figure 34. Field trial 1973-74. Index of decay for stakes of Scots pine treated with Boliden P50 B.



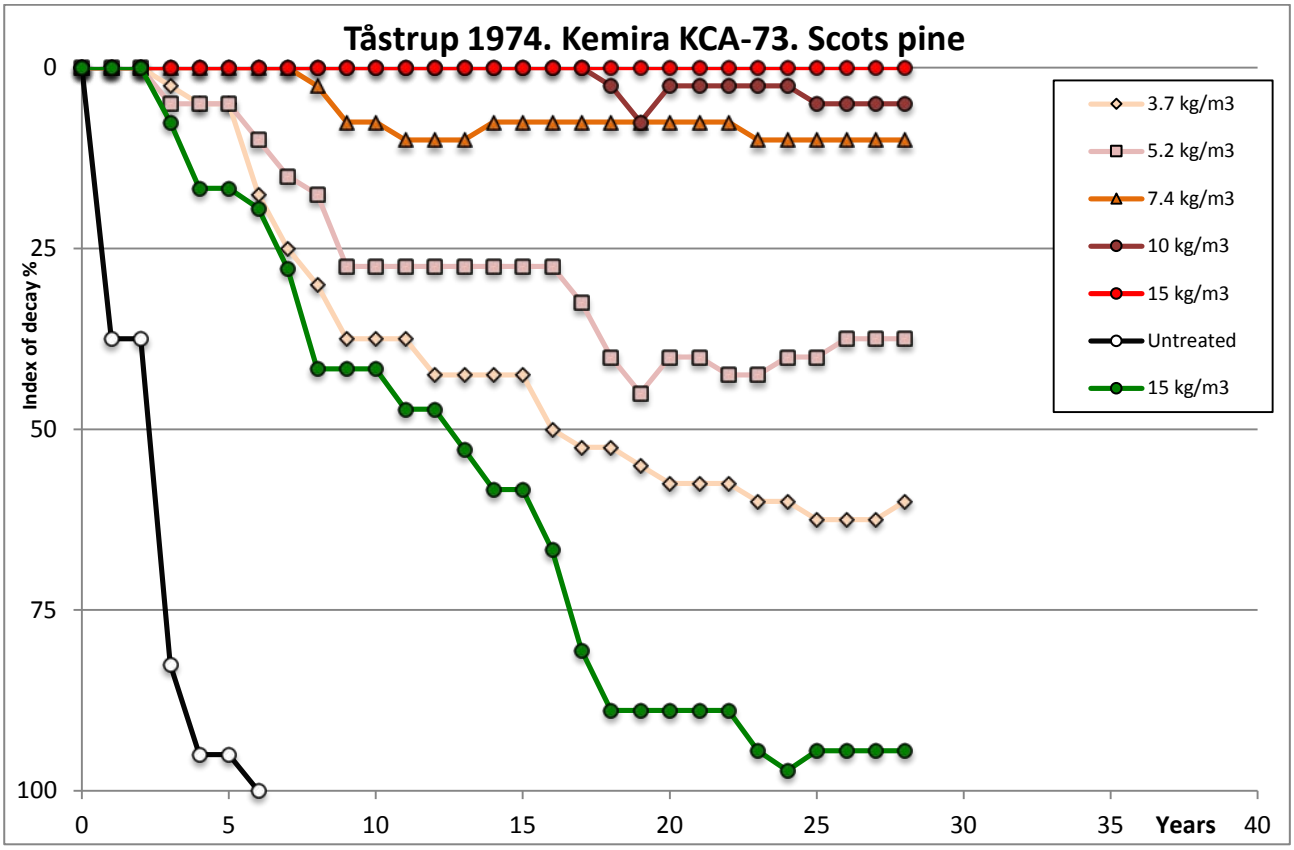
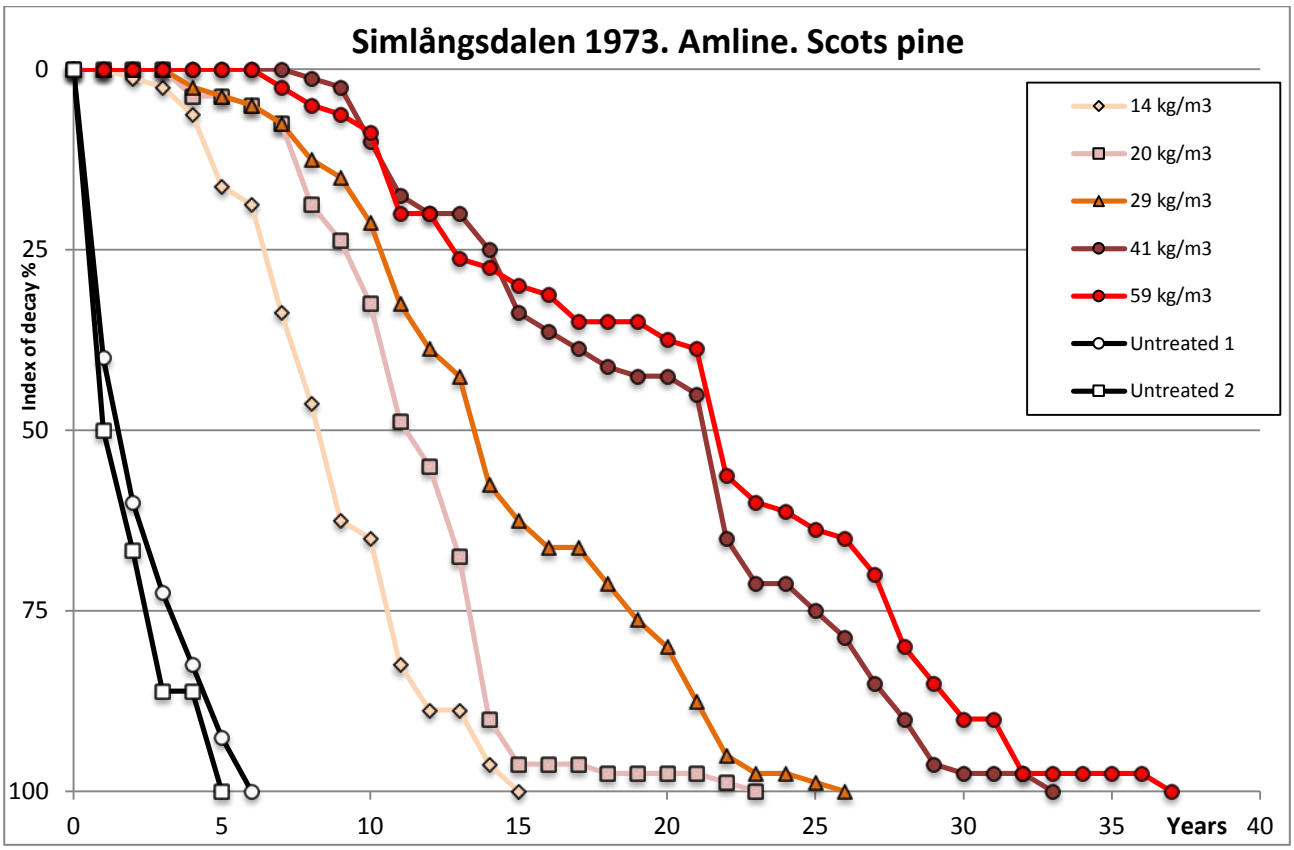


Figure 35. Field trial 1973-74. Index of decay for stakes of Scots pine treated with Kemira KCA-73.



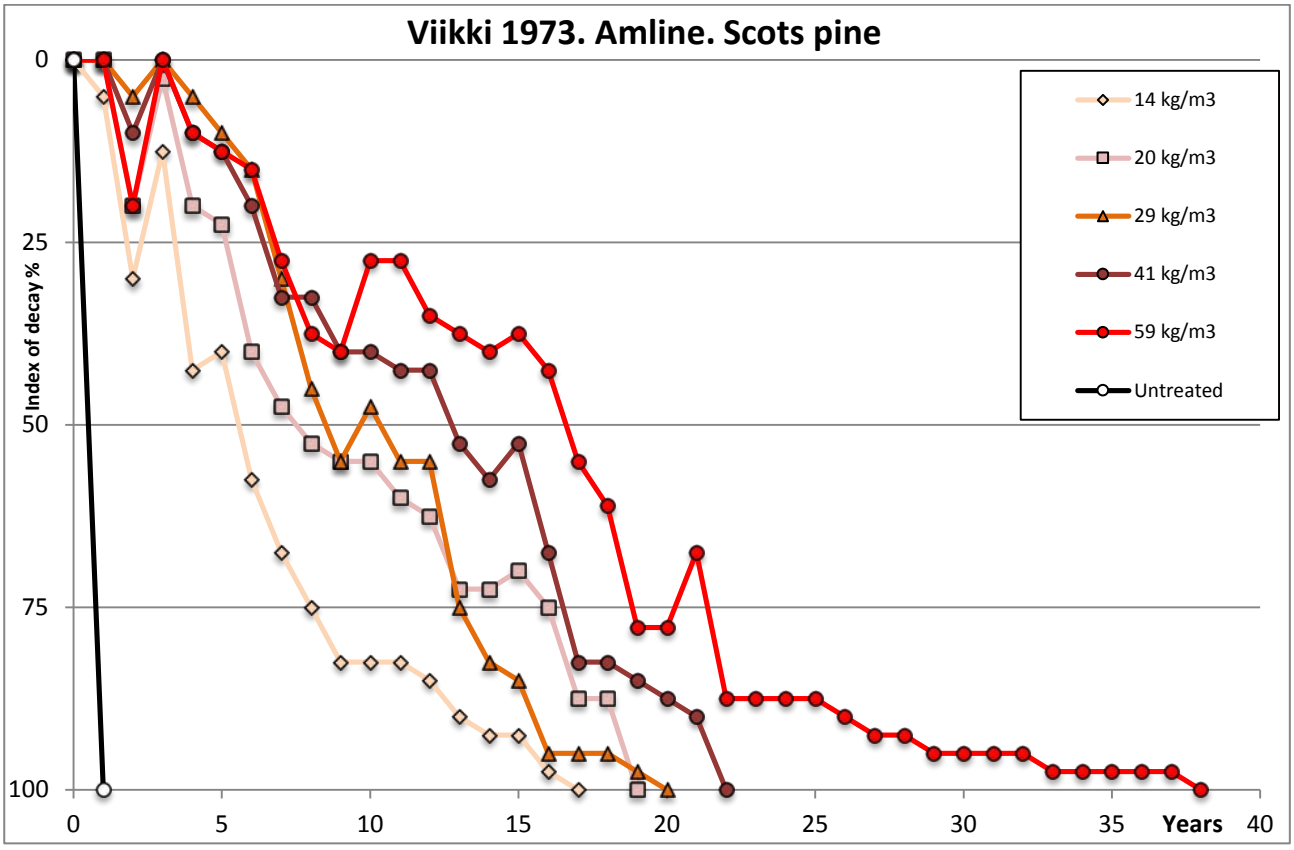
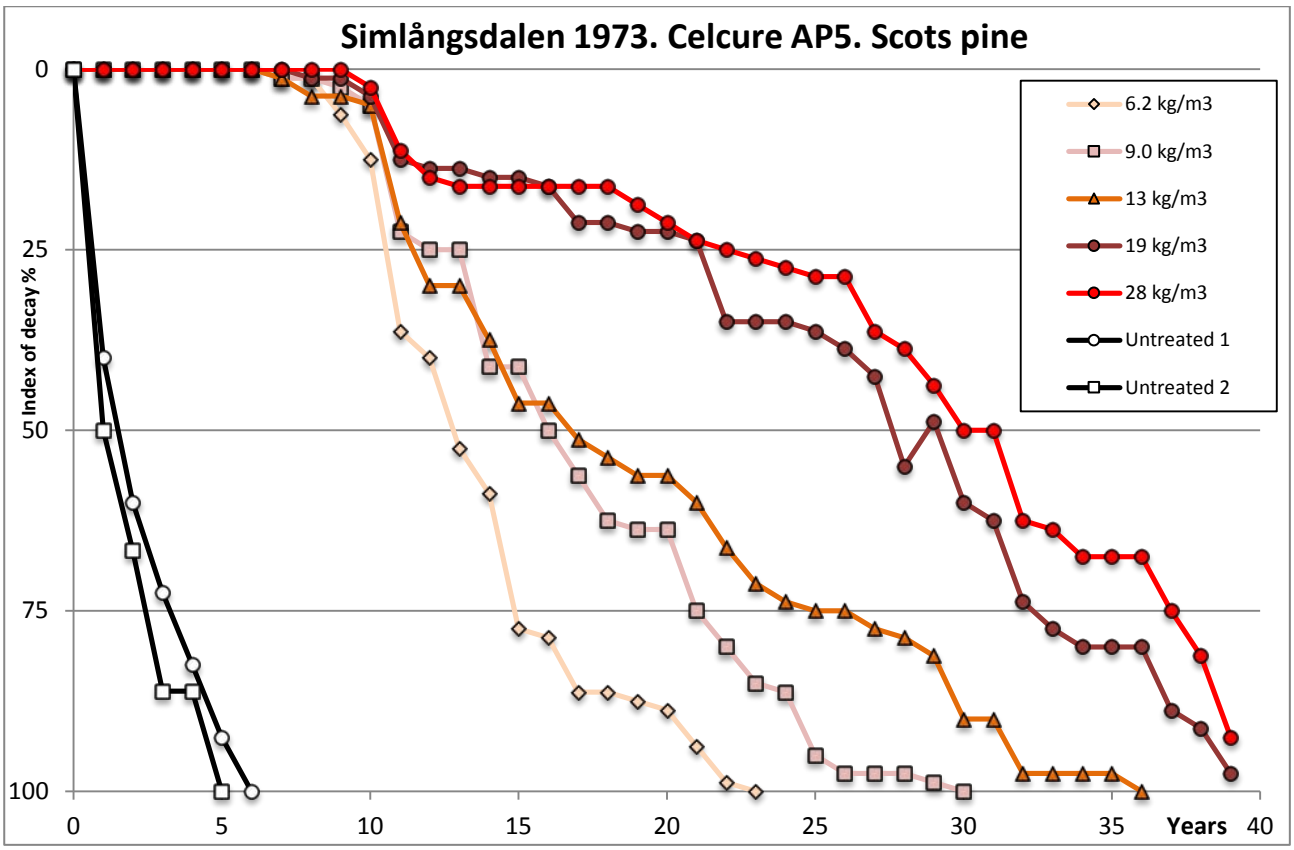


Figure 36. Field trial 1973-74. Index of decay for stakes of Scots pine treated with Amline.



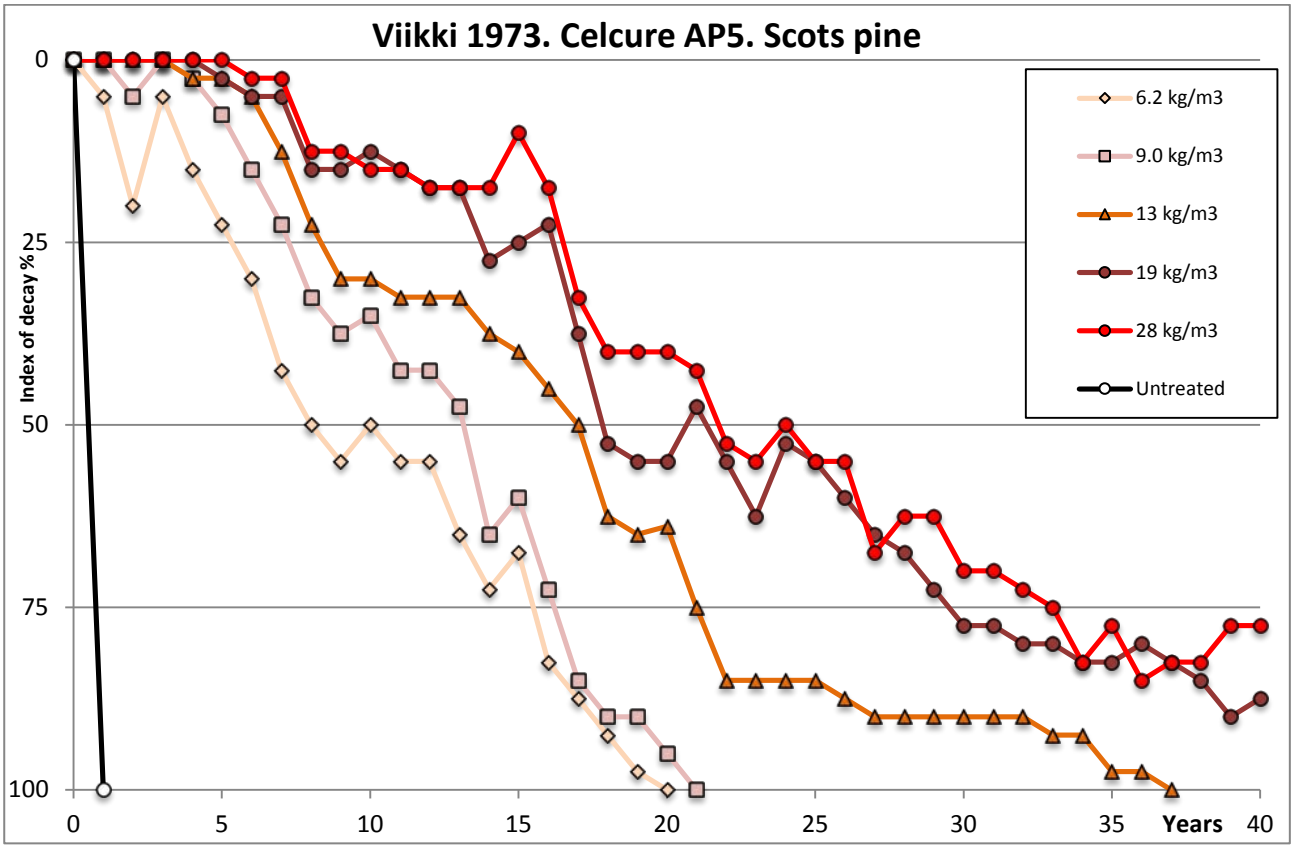
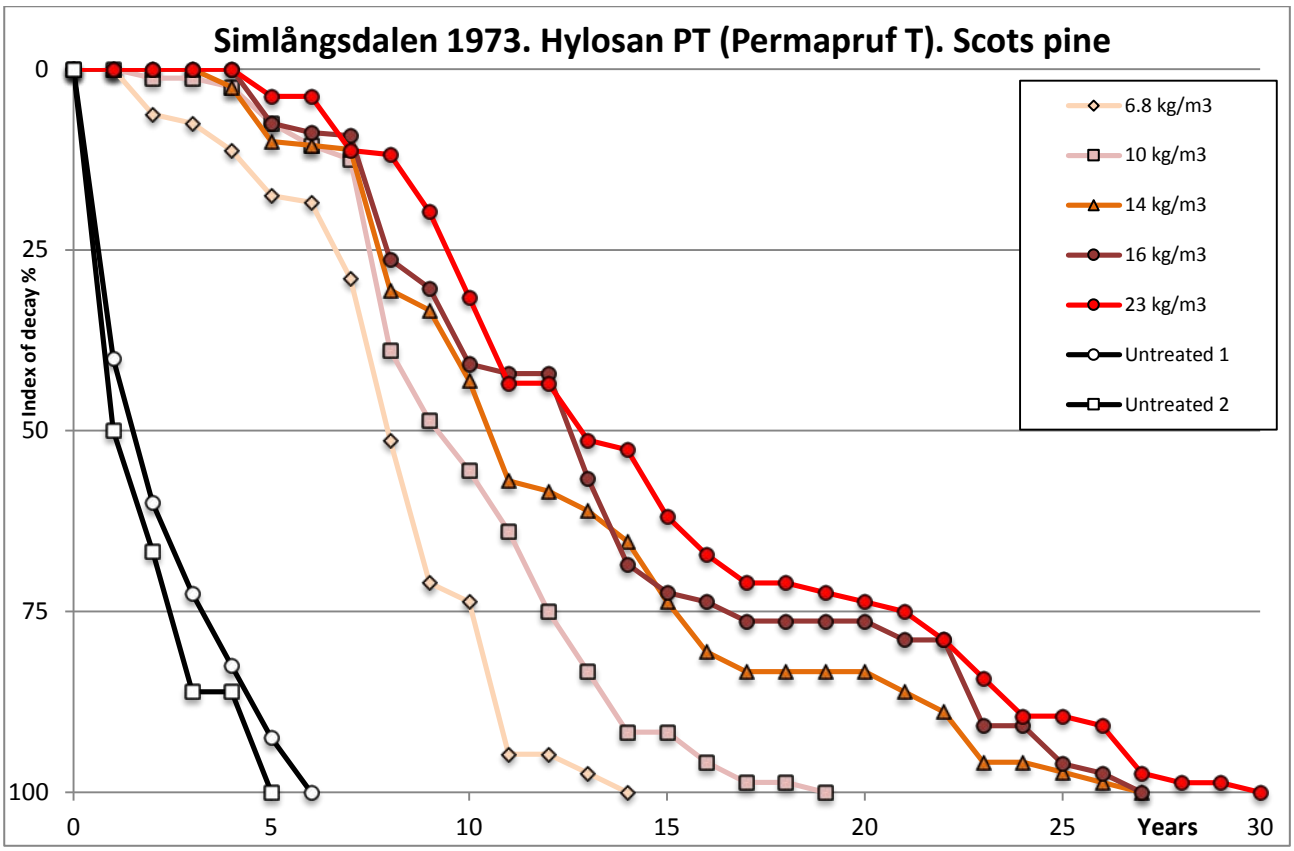


Figure 37. Field trial 1973-74. Index of decay for stakes of Scots pine treated with Celcure AP5.



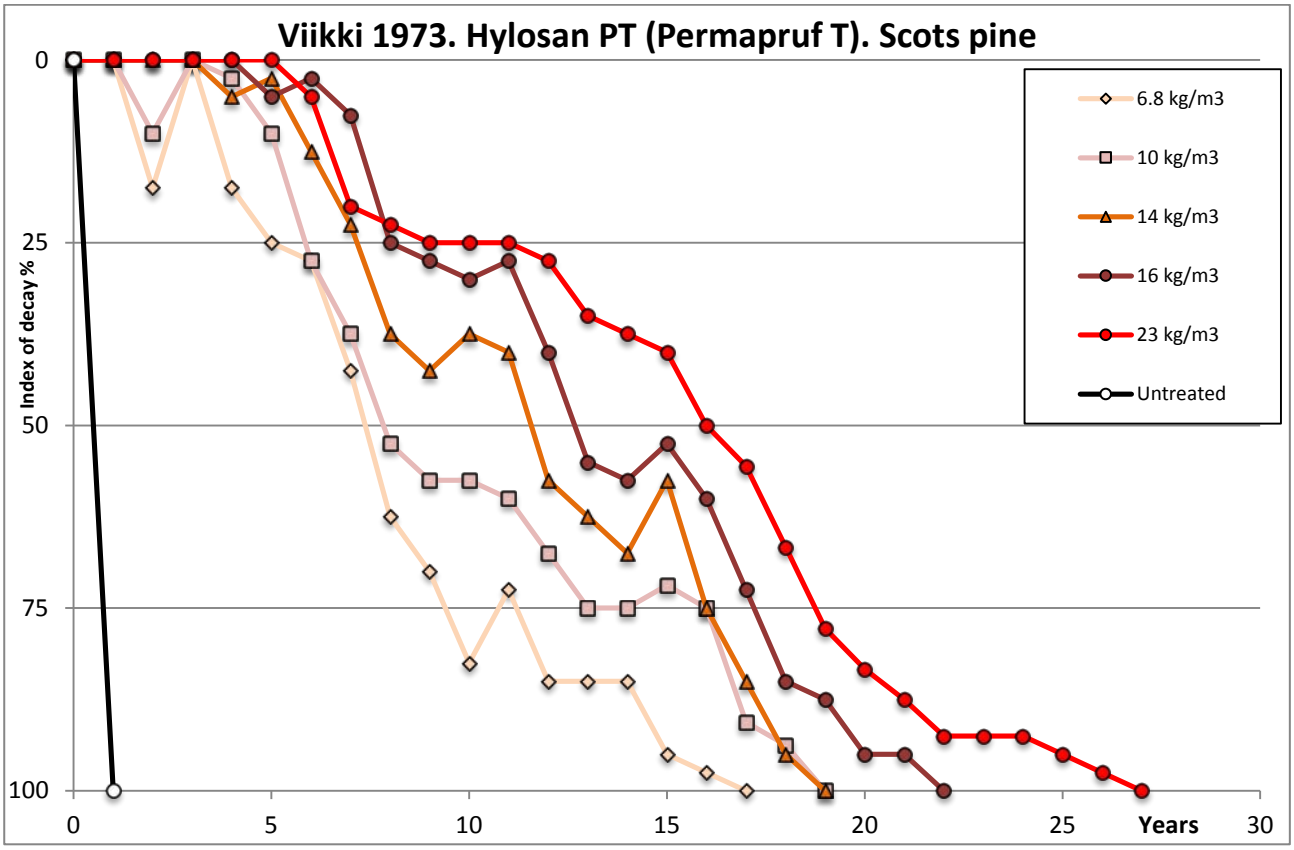
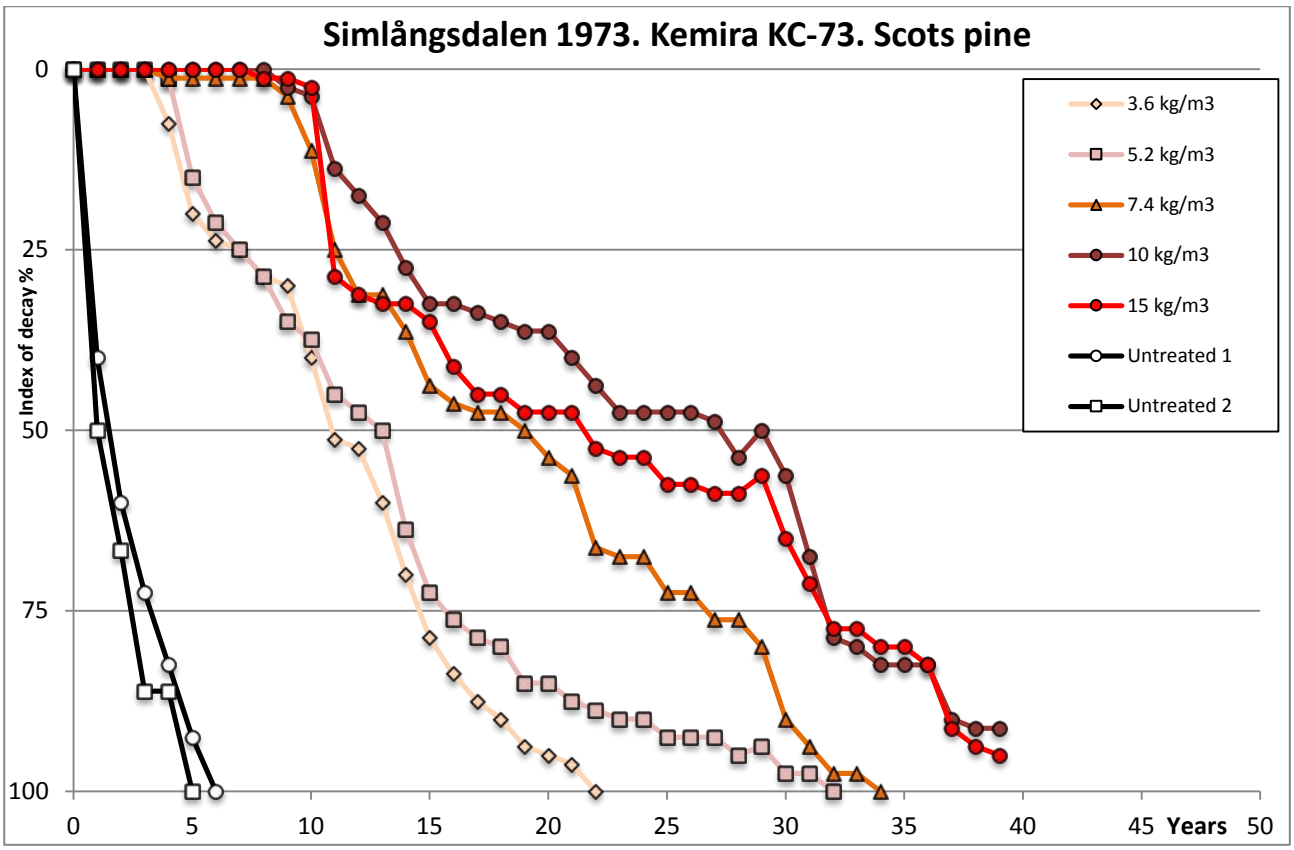


Figure 38. Field trial 1973-74. Index of decay for stakes of Scots pine treated with Hylosan PT (Permapruf T).



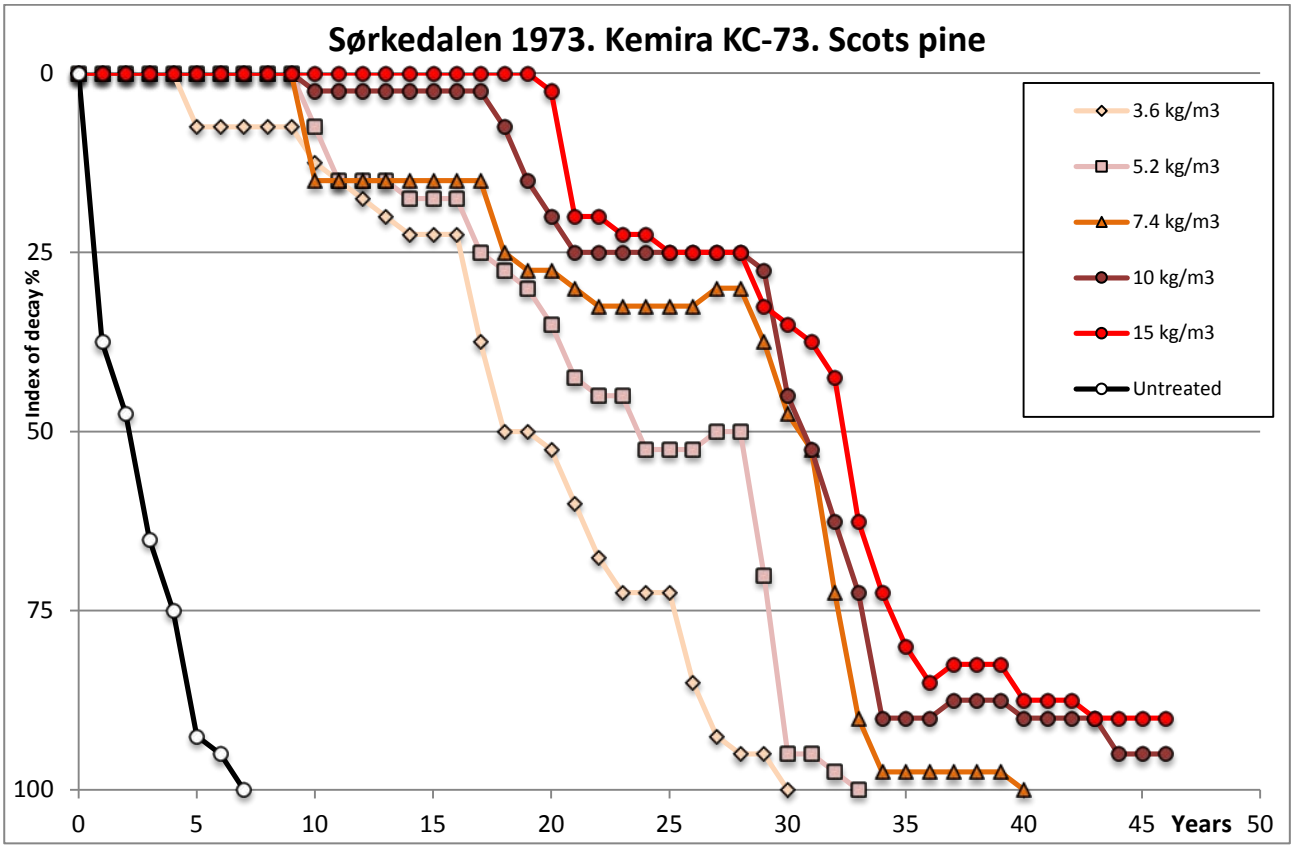
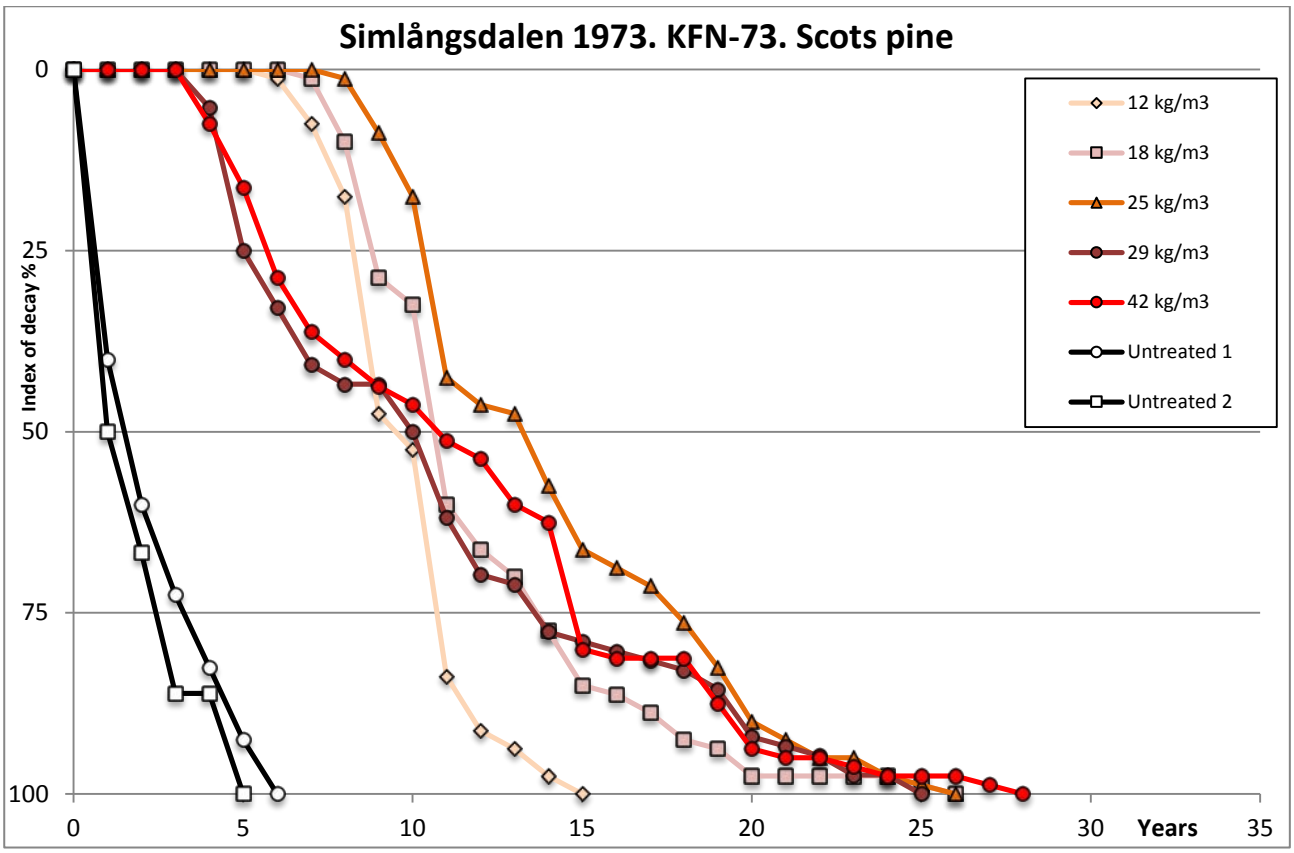


Figure 39. Field trial 1973-74. Index of decay for stakes of Scots pine treated with Kemira KC-73.



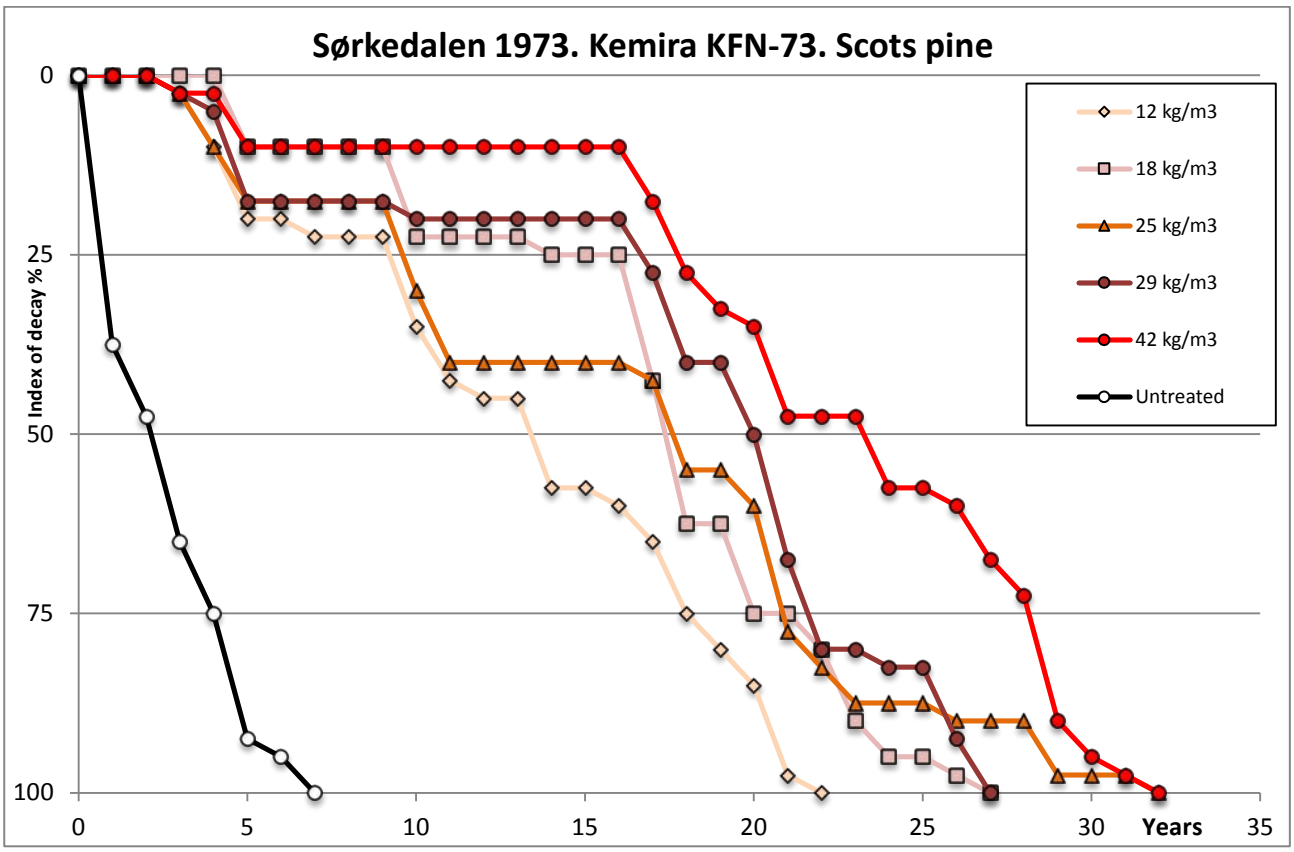
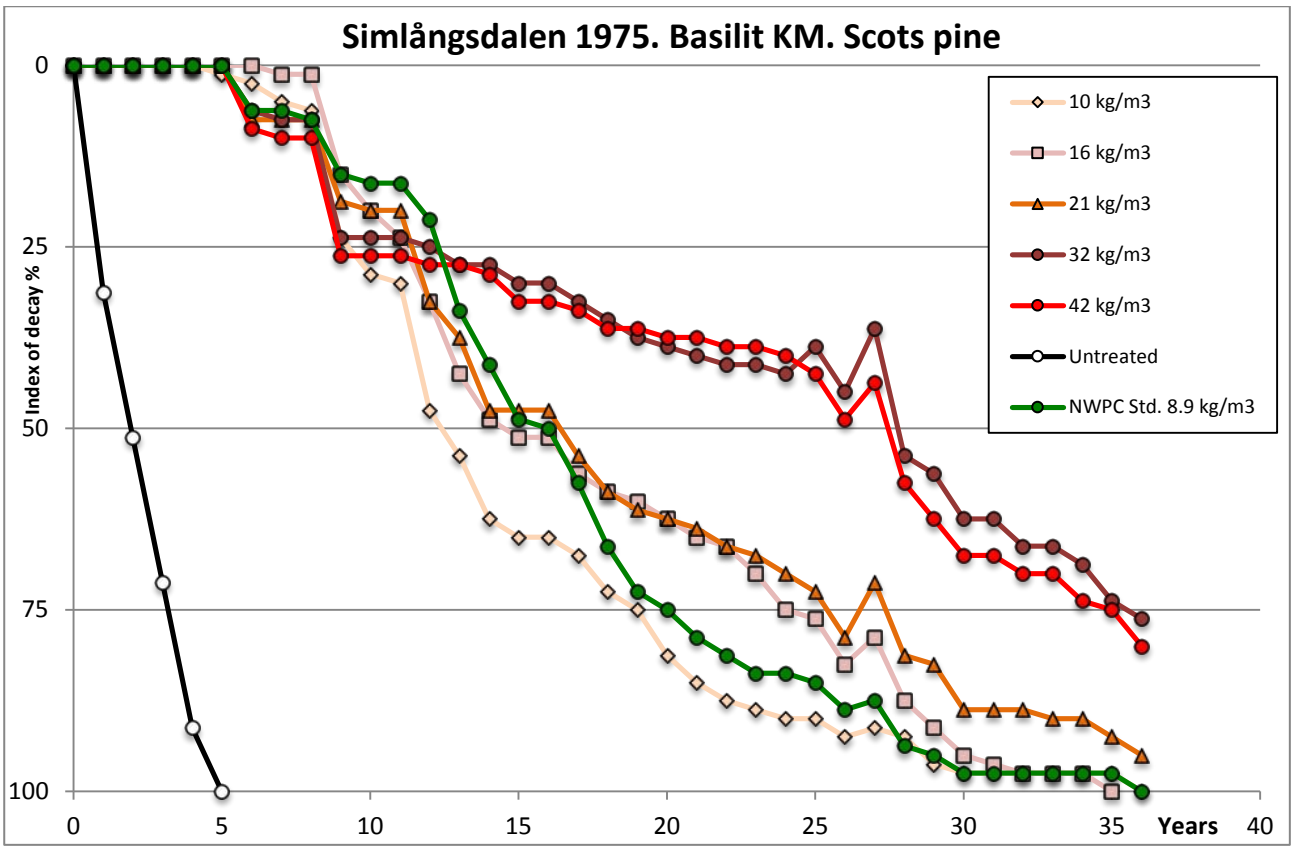


Figure 40. Field trial 1973-74. Index of decay for stakes of Scots pine treated with Kemira KFN-73.



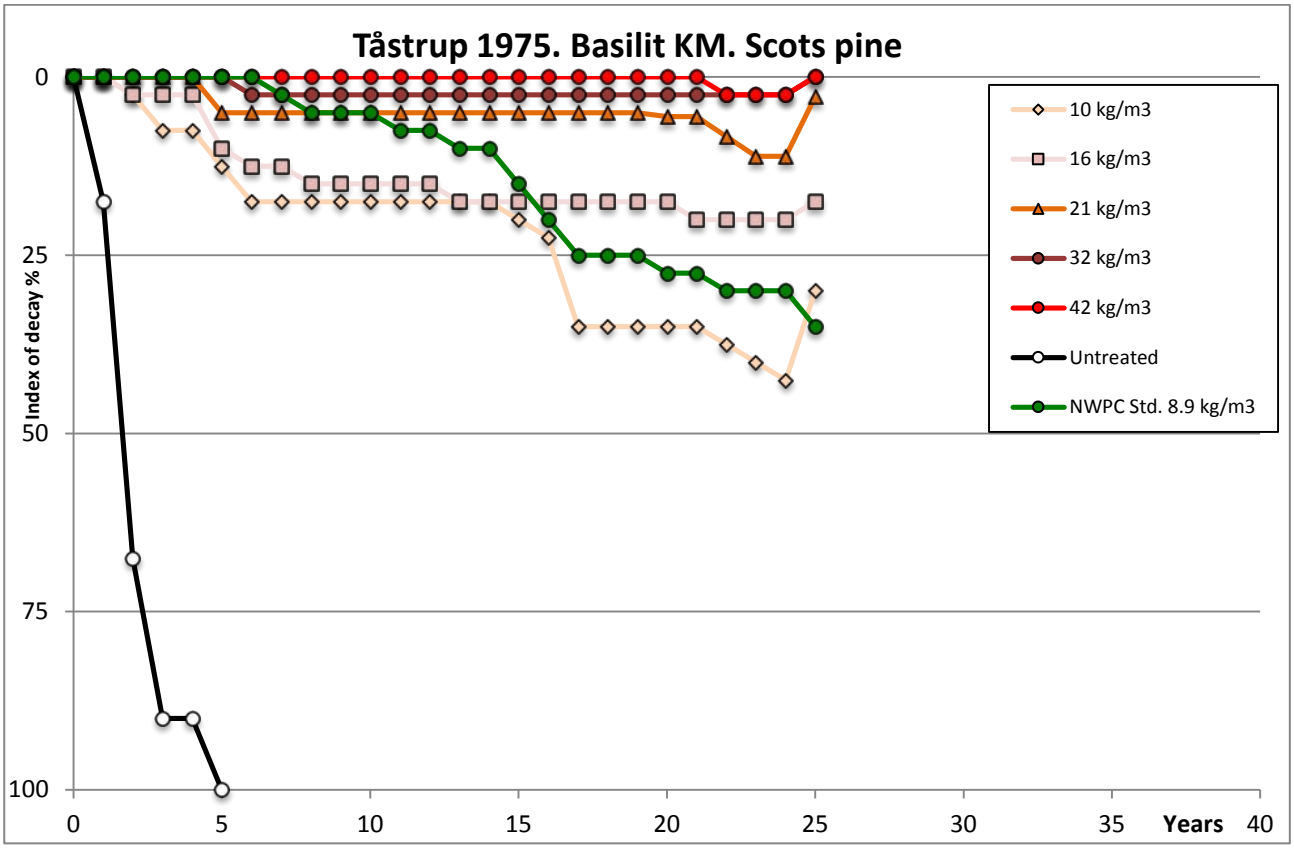
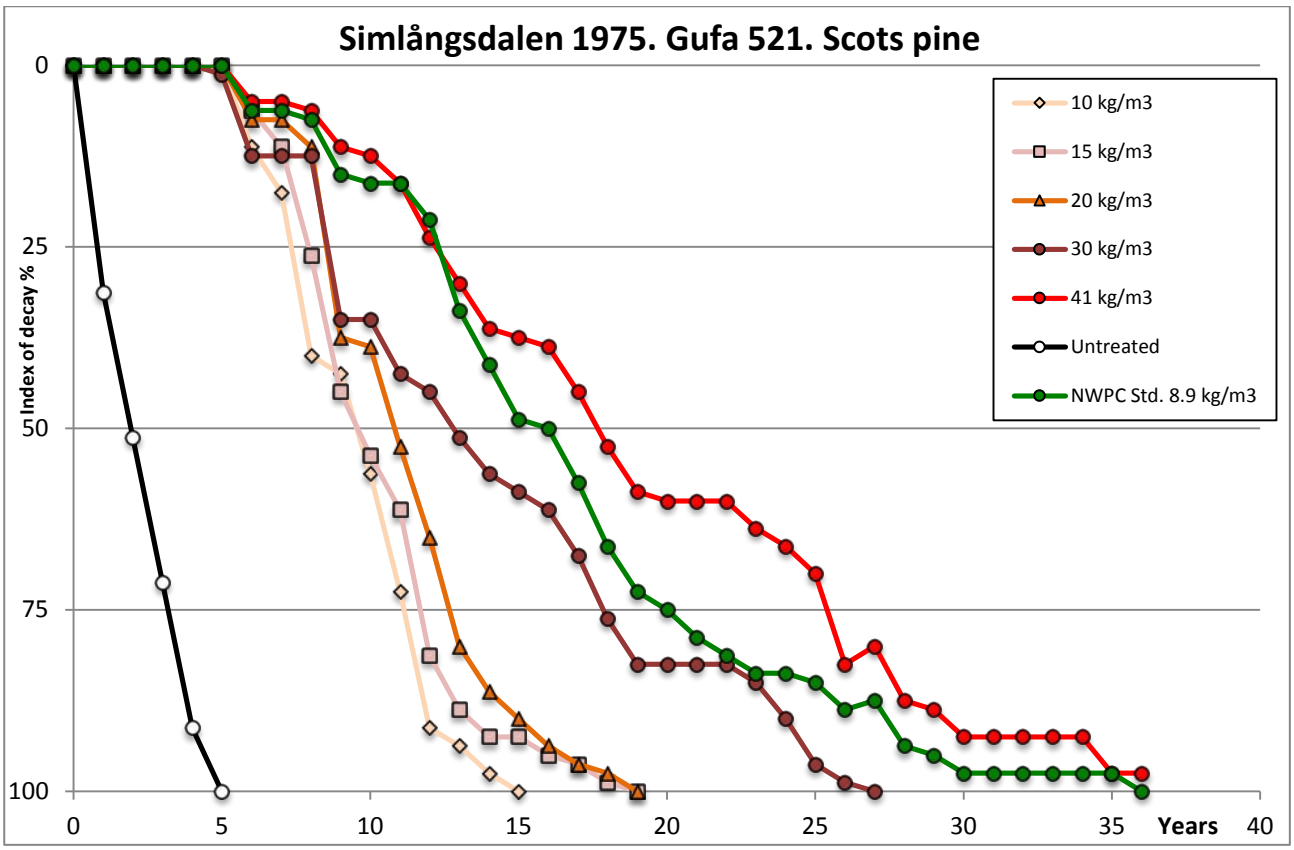


Figure 41. Field trial 1975. Index of decay for stakes of Scots pine treated with Basilit KM.



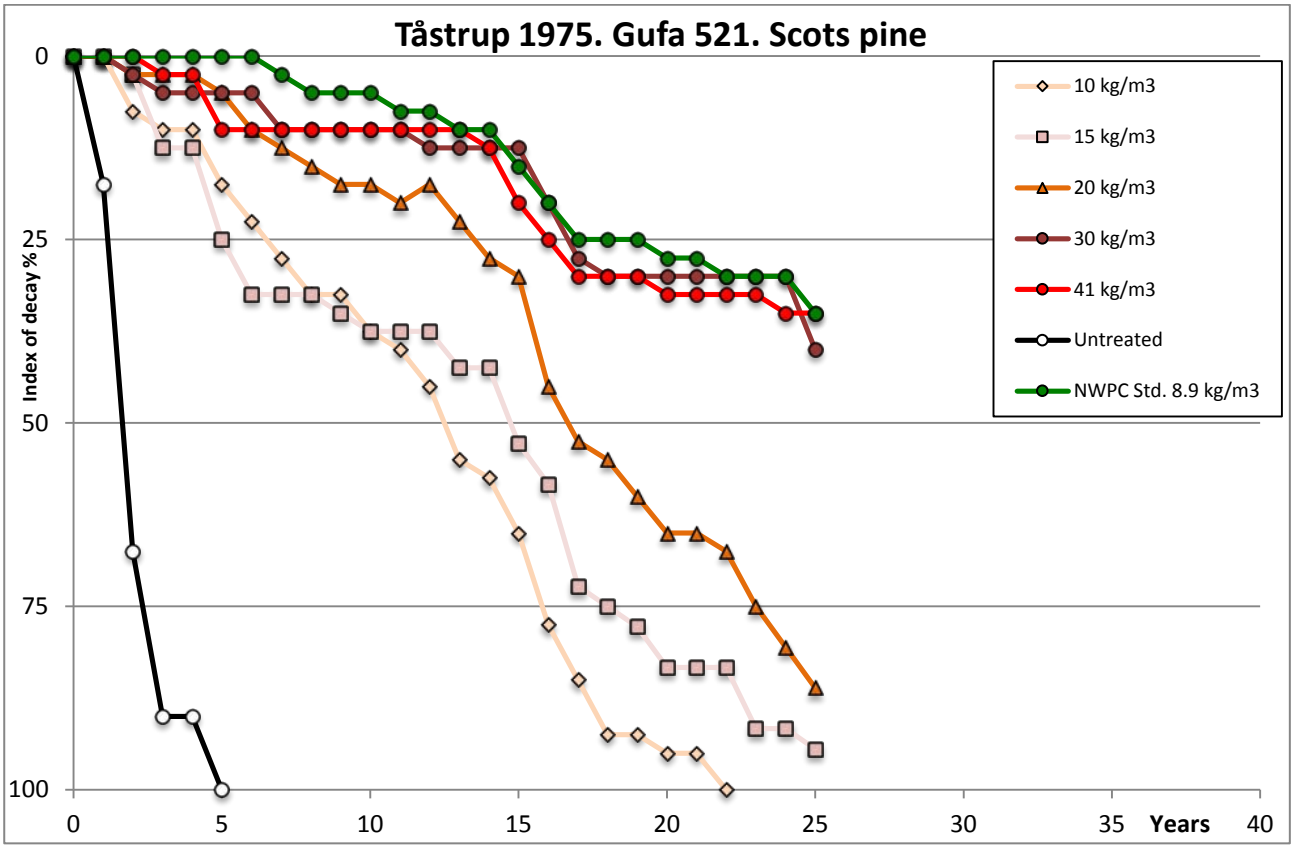
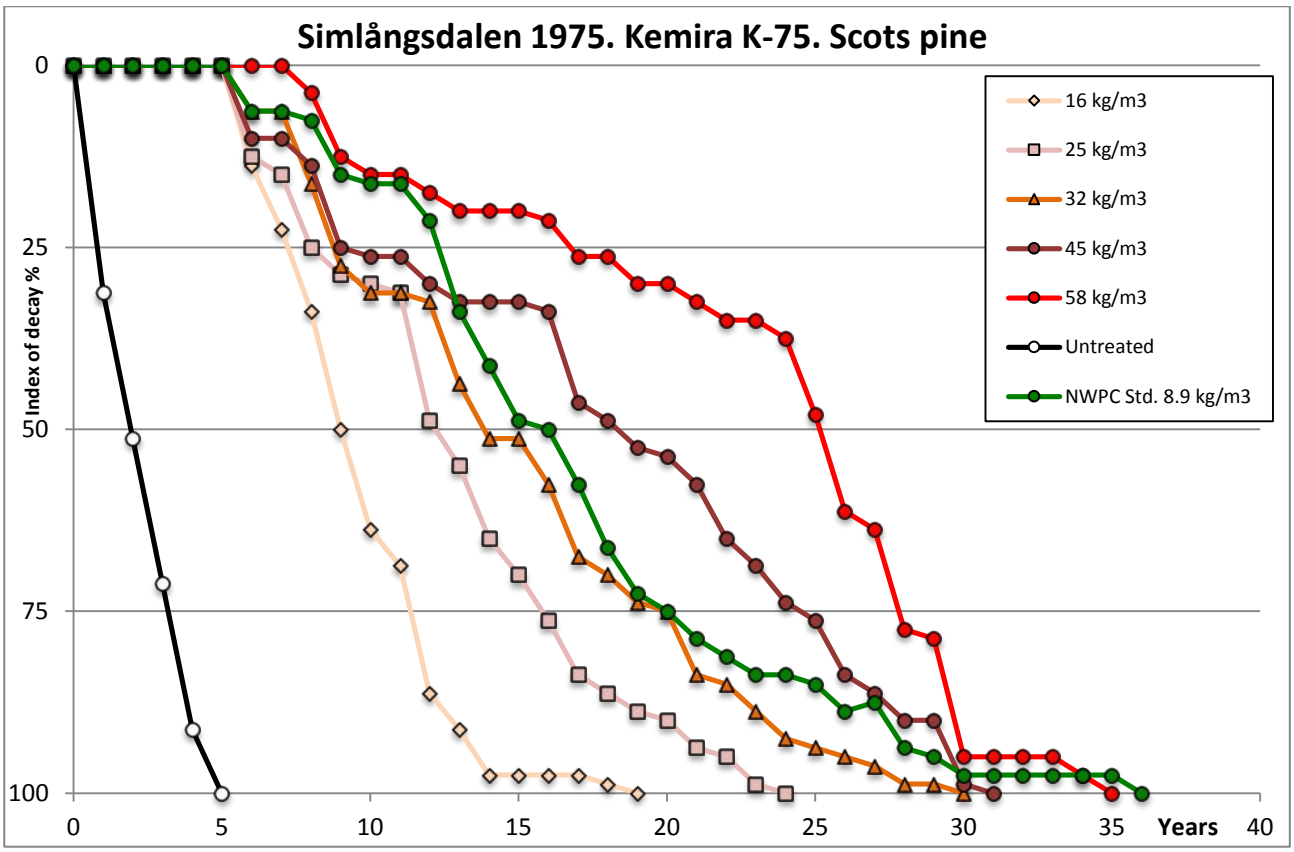


Figure 42. Field trial 1975. Index of decay for stakes of Scots pine treated with Gufa 521.



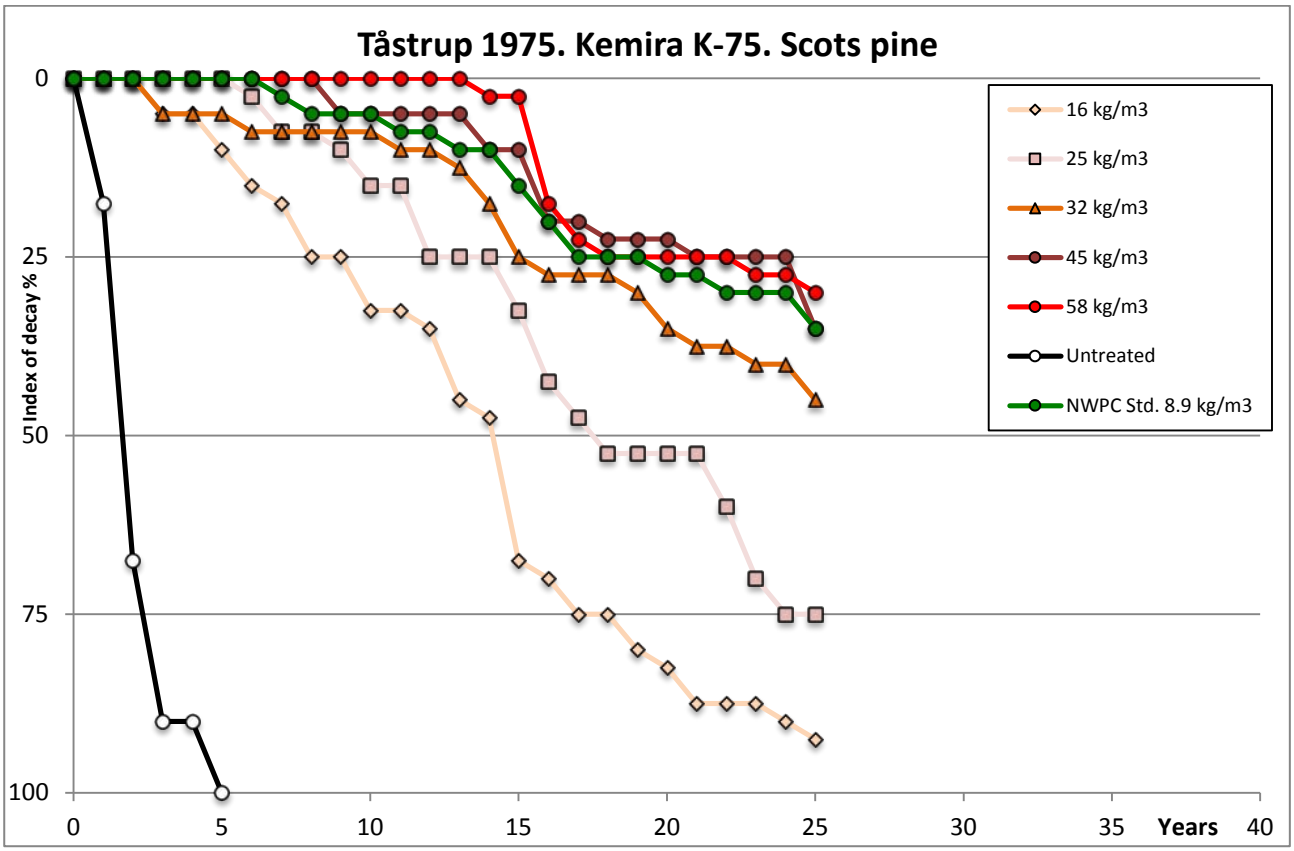
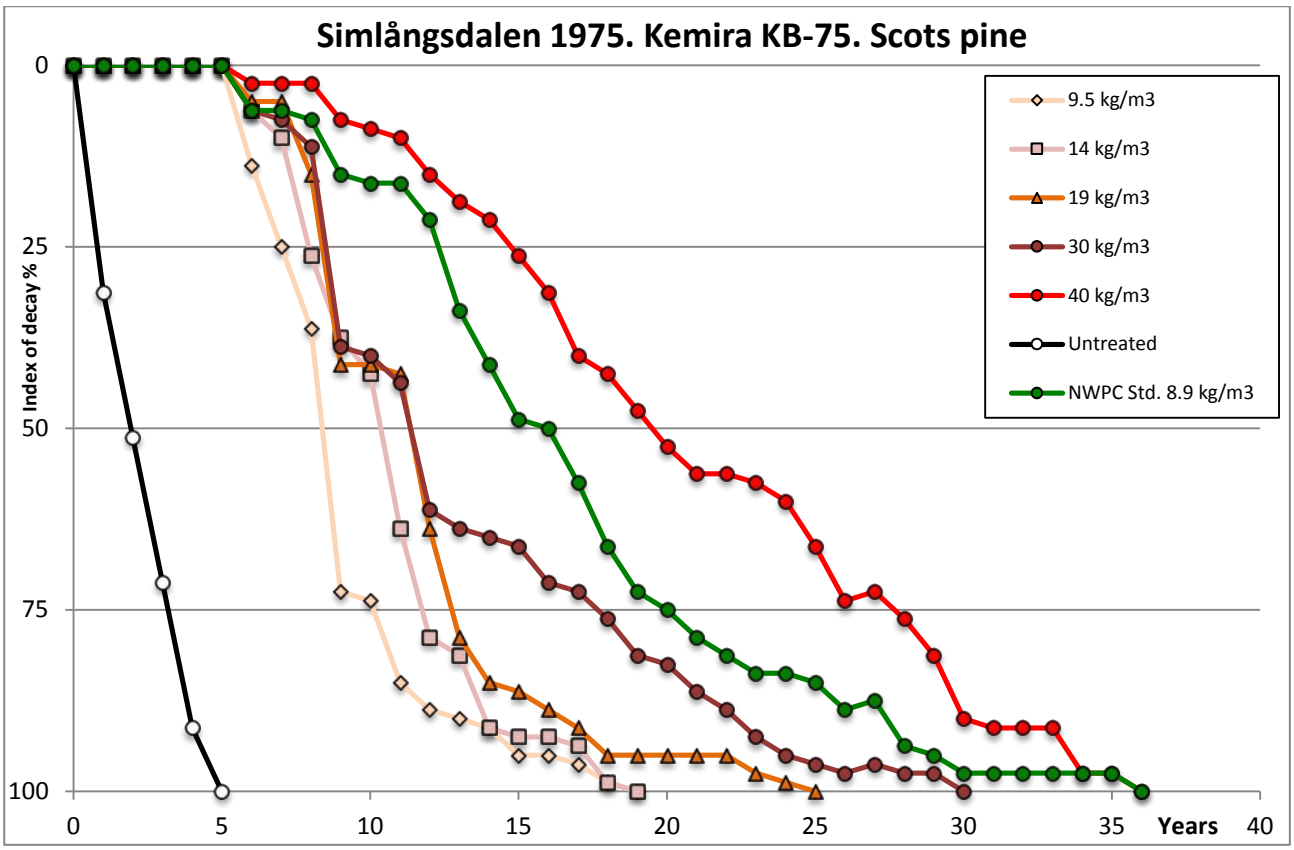


Figure 43. Field trial 1975. Index of decay for stakes of Scots pine treated with Kemira K-75.



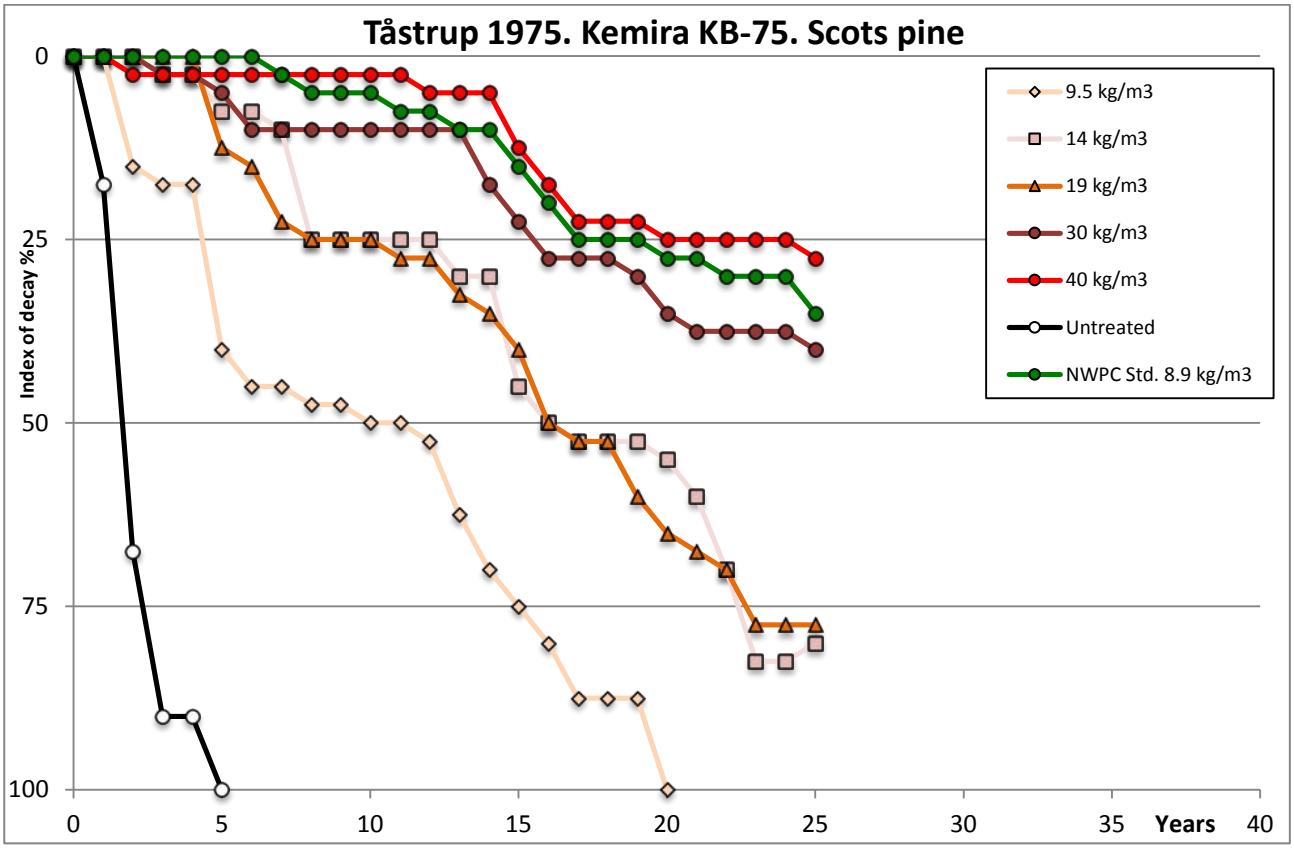
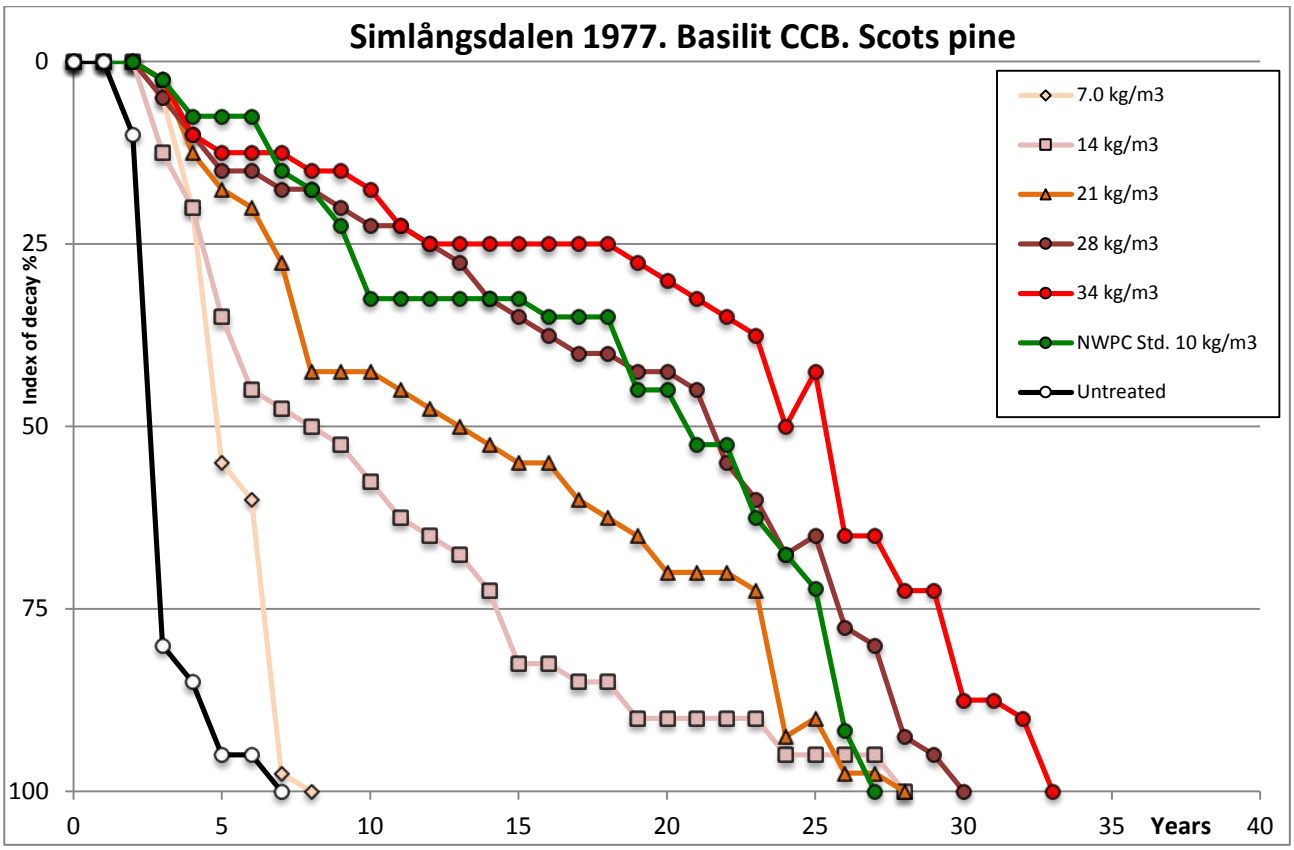


Figure 44. Field trial 1975. Index of decay for stakes of Scots pine treated with Kemira KB-75.



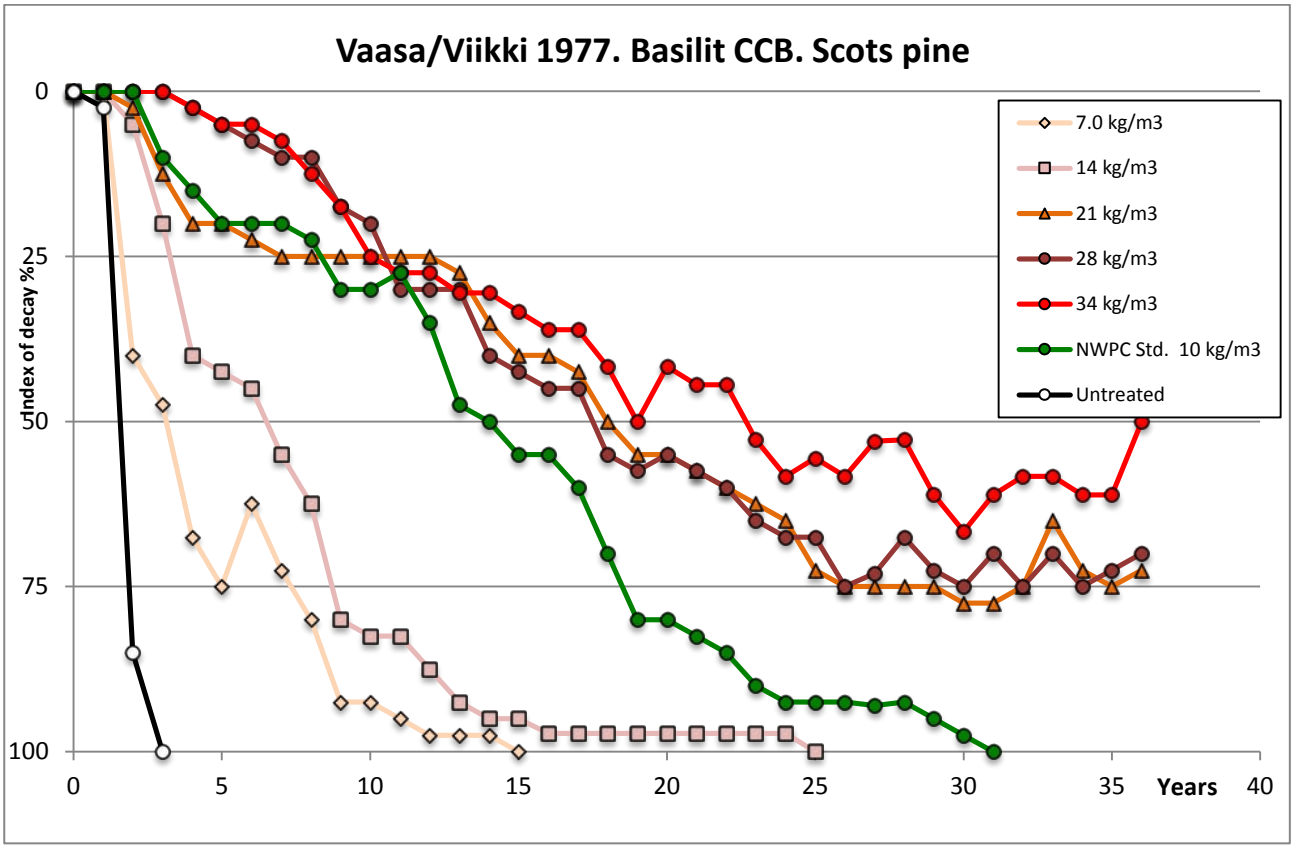


Figure 45. Field trial 1977-78. Index of decay for stakes of Scots pine treated with Basilit CCB.

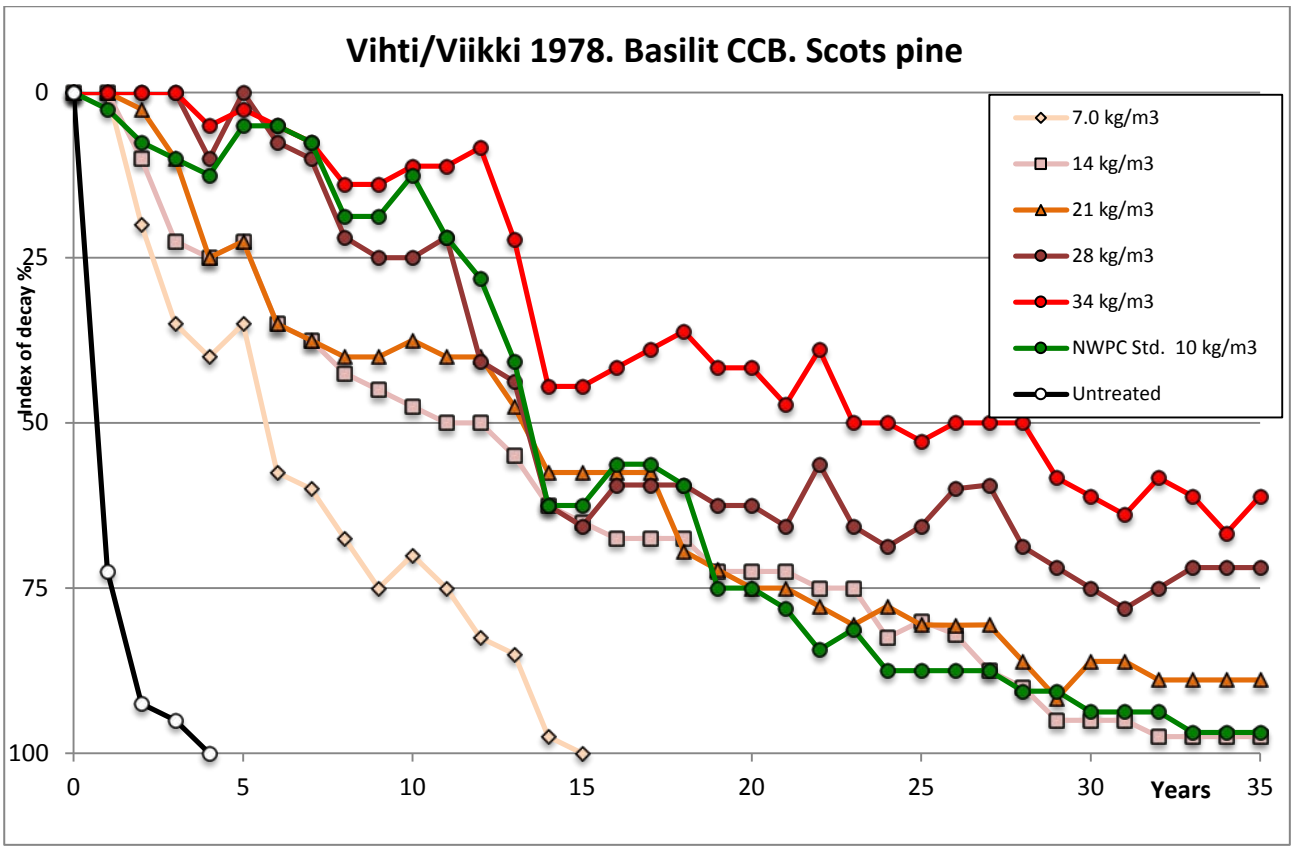


Figure 46. Field trial 1977-78. Index of decay for stakes of Scots pine treated with Basilit CCB.

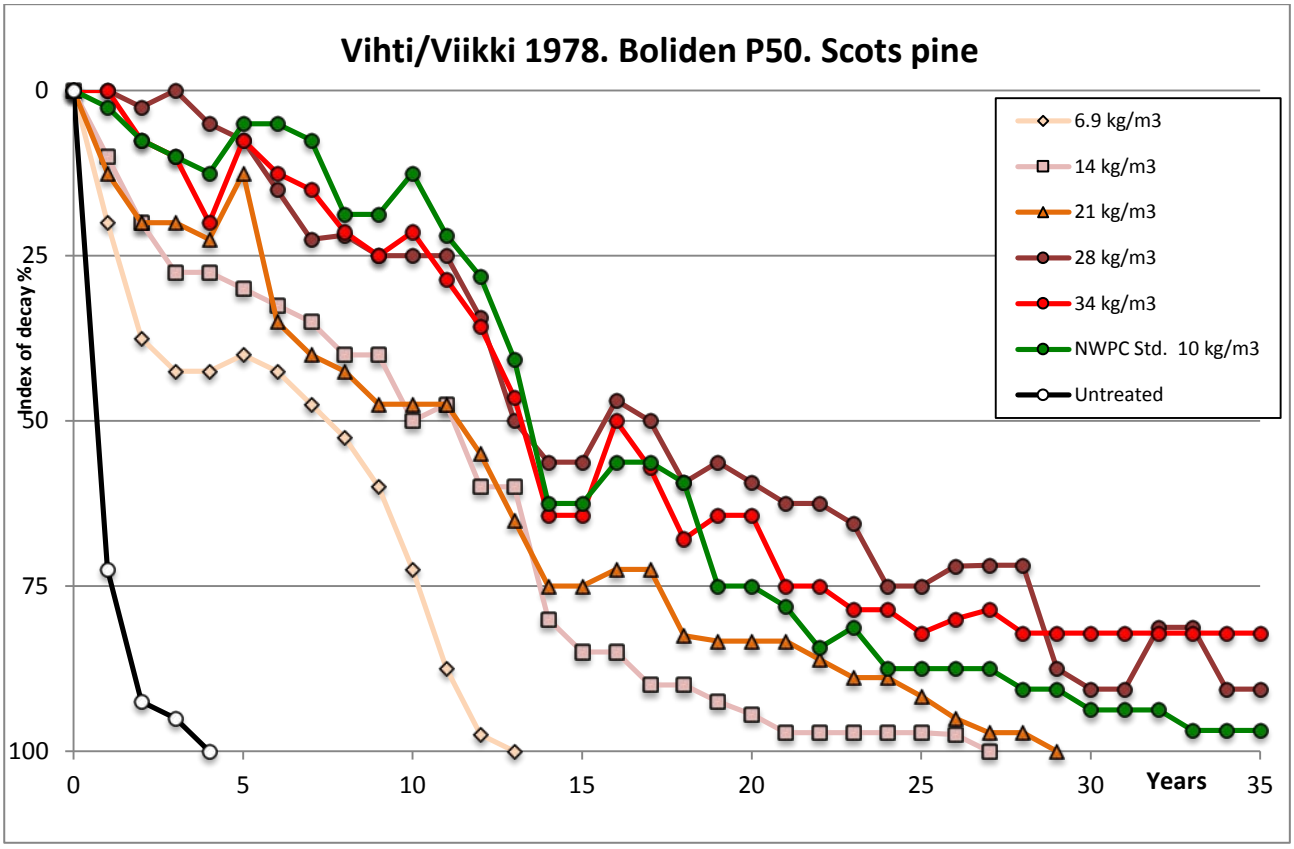
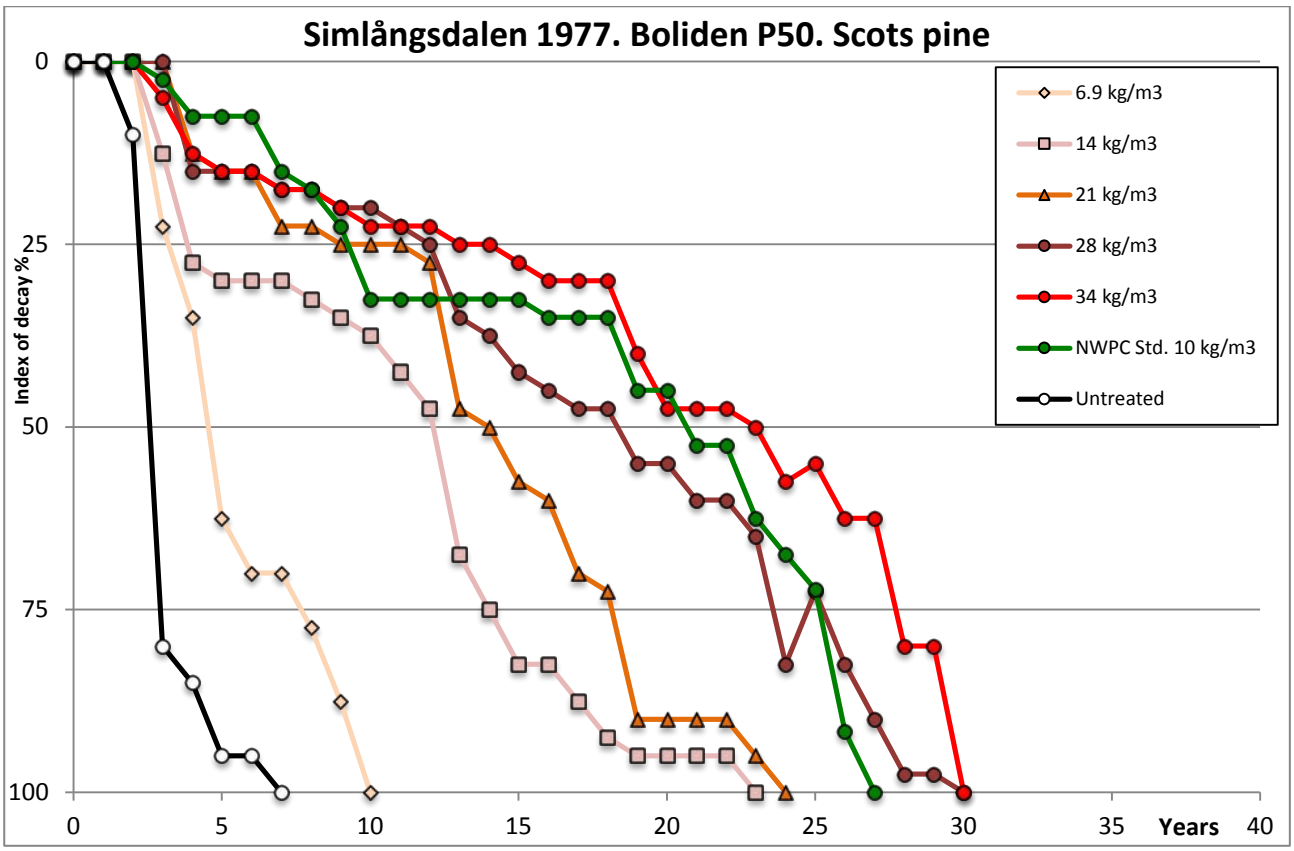


Figure 47. Field trial 1977-78. Index of decay for stakes of Scots pine treated with Boliden P50.



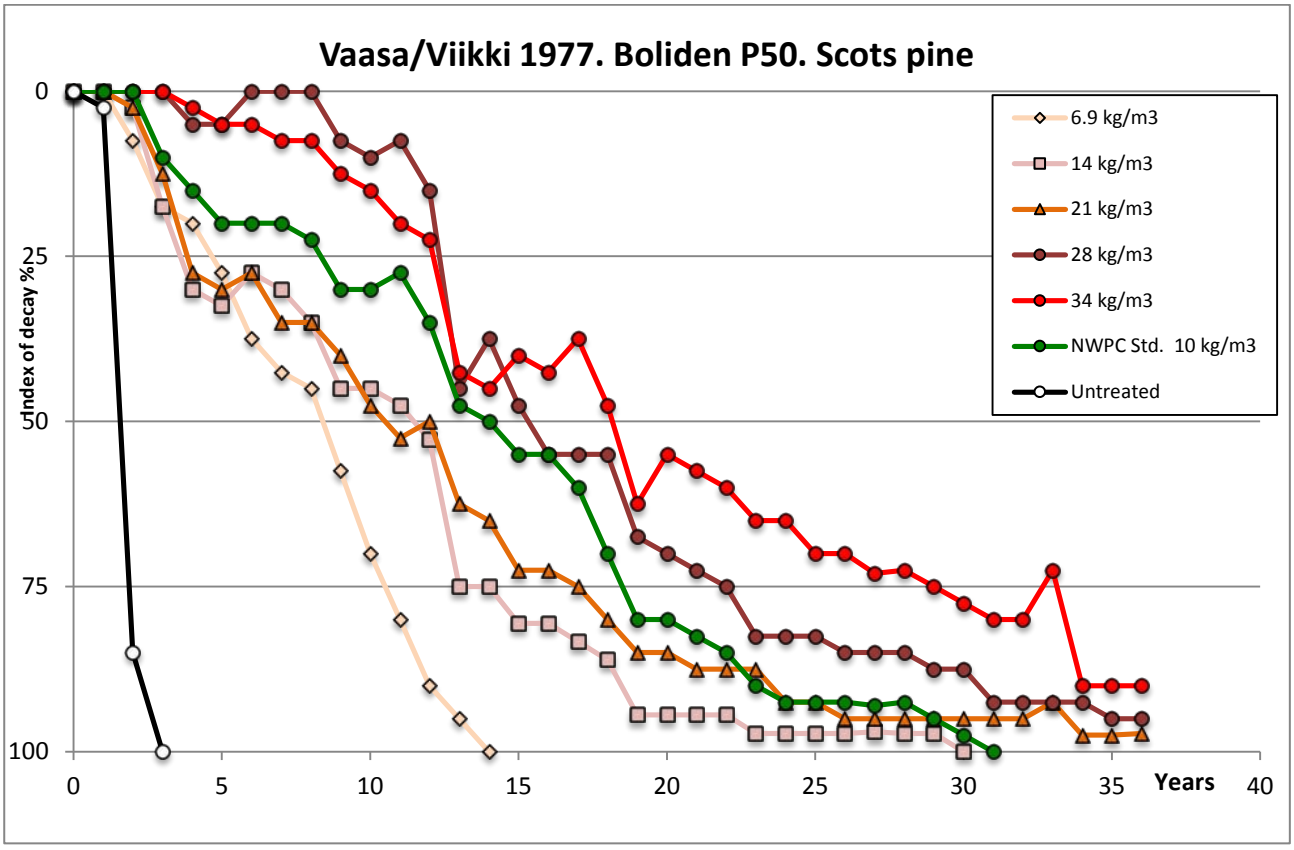
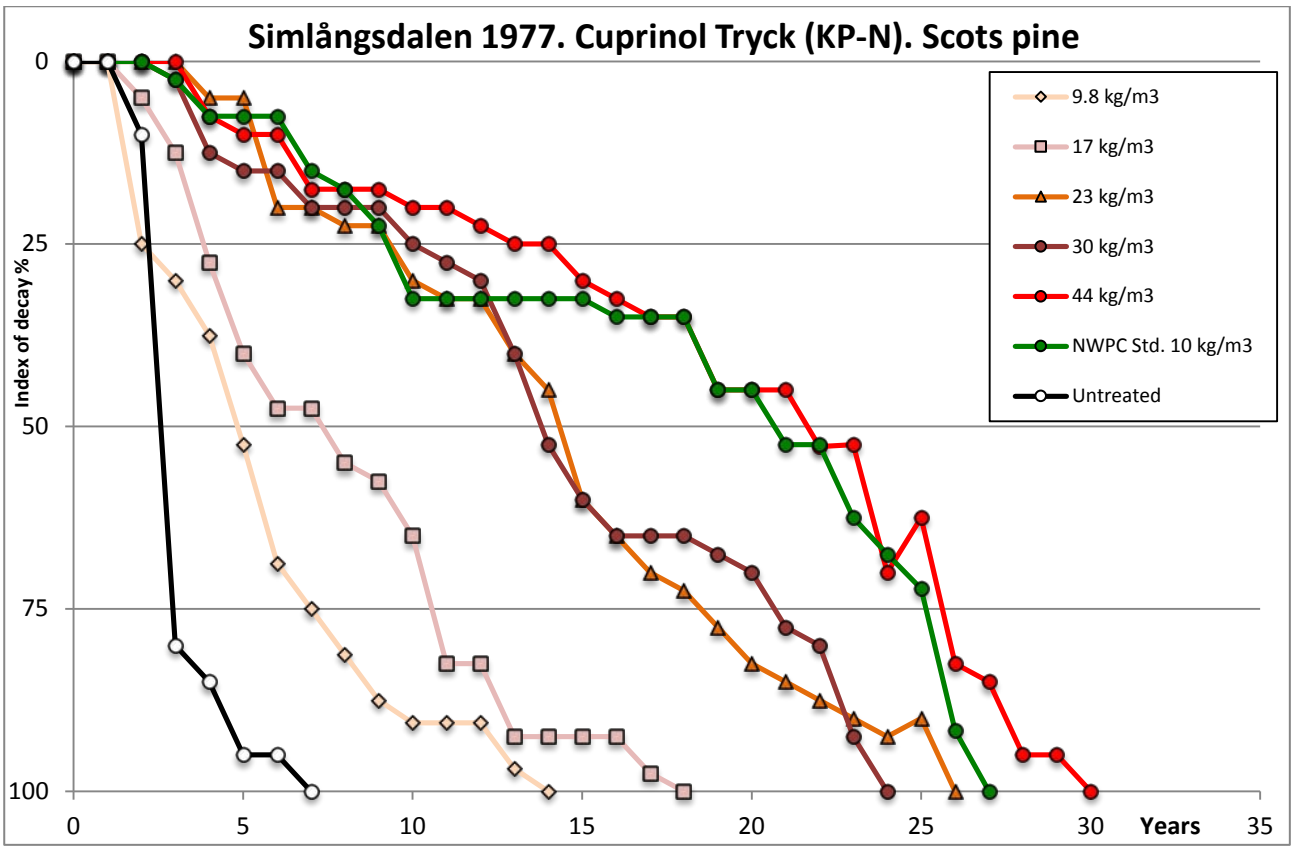


Figure 48. Field trial 1977-78. Index of decay for stakes of Scots pine treated with Boliden P50.



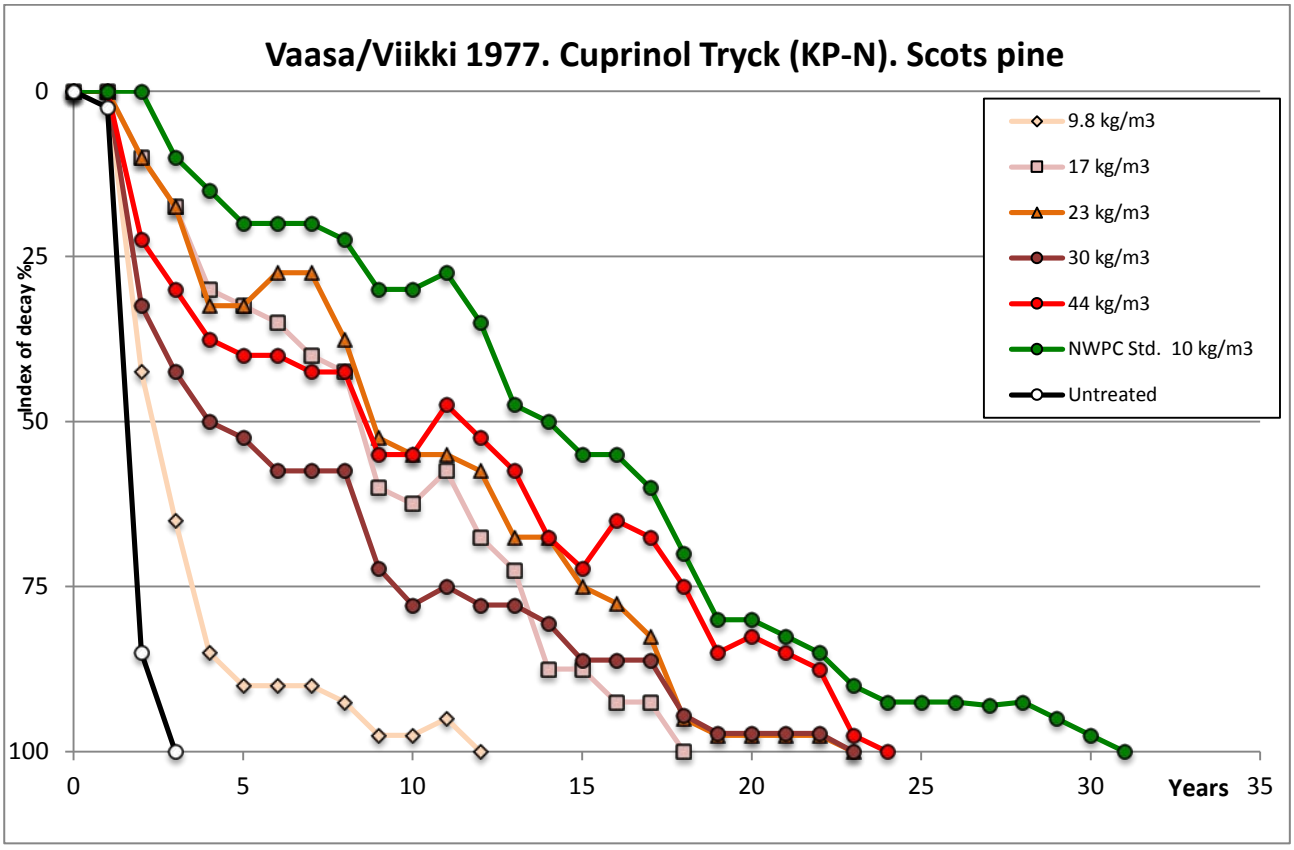


Figure 49. Field trial 1977-78. Index of decay for stakes of Scots pine treated with Cuprinol Tryck (KP-N).

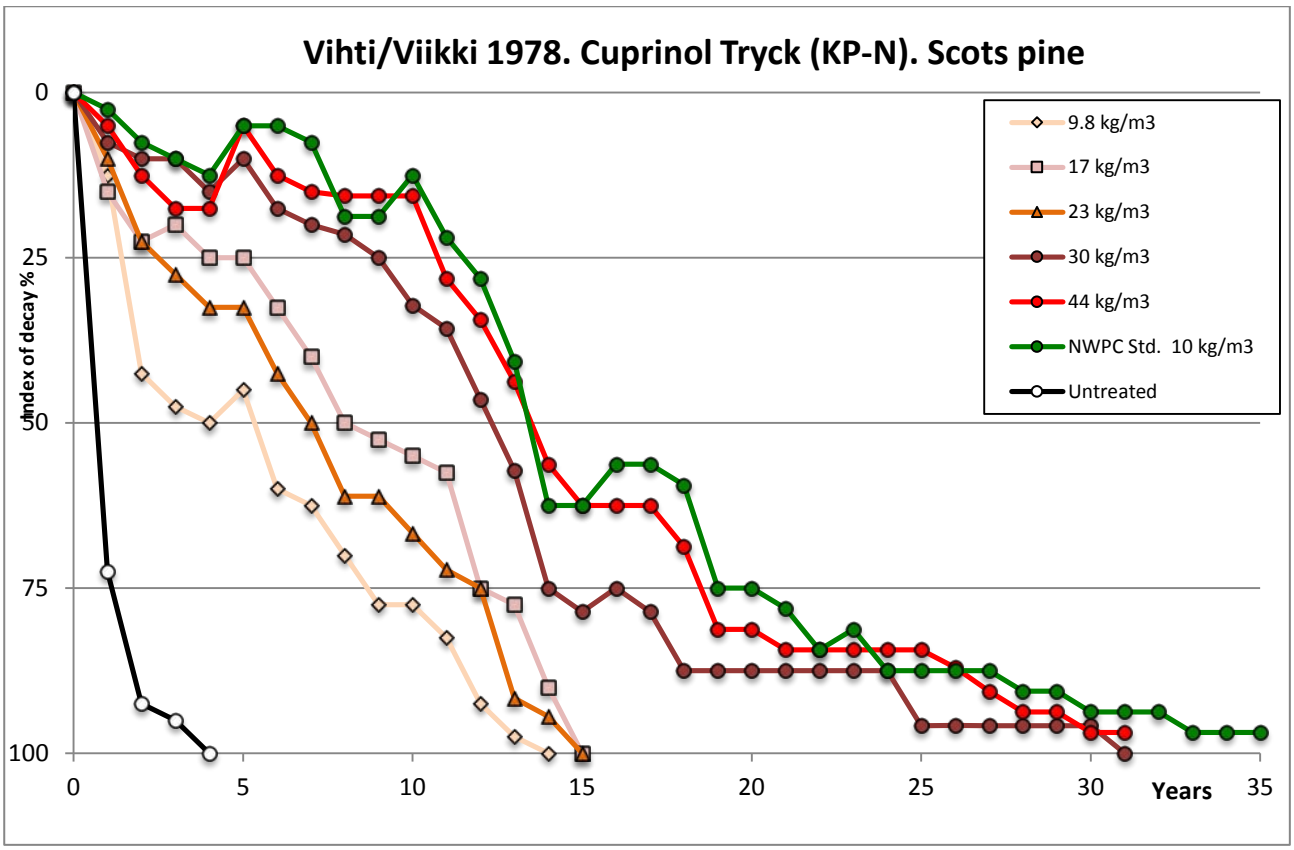


Figure 50. Field trial 1977-78. Index of decay for stakes of Scots pine treated with Cuprinol Tryck (KP-N).

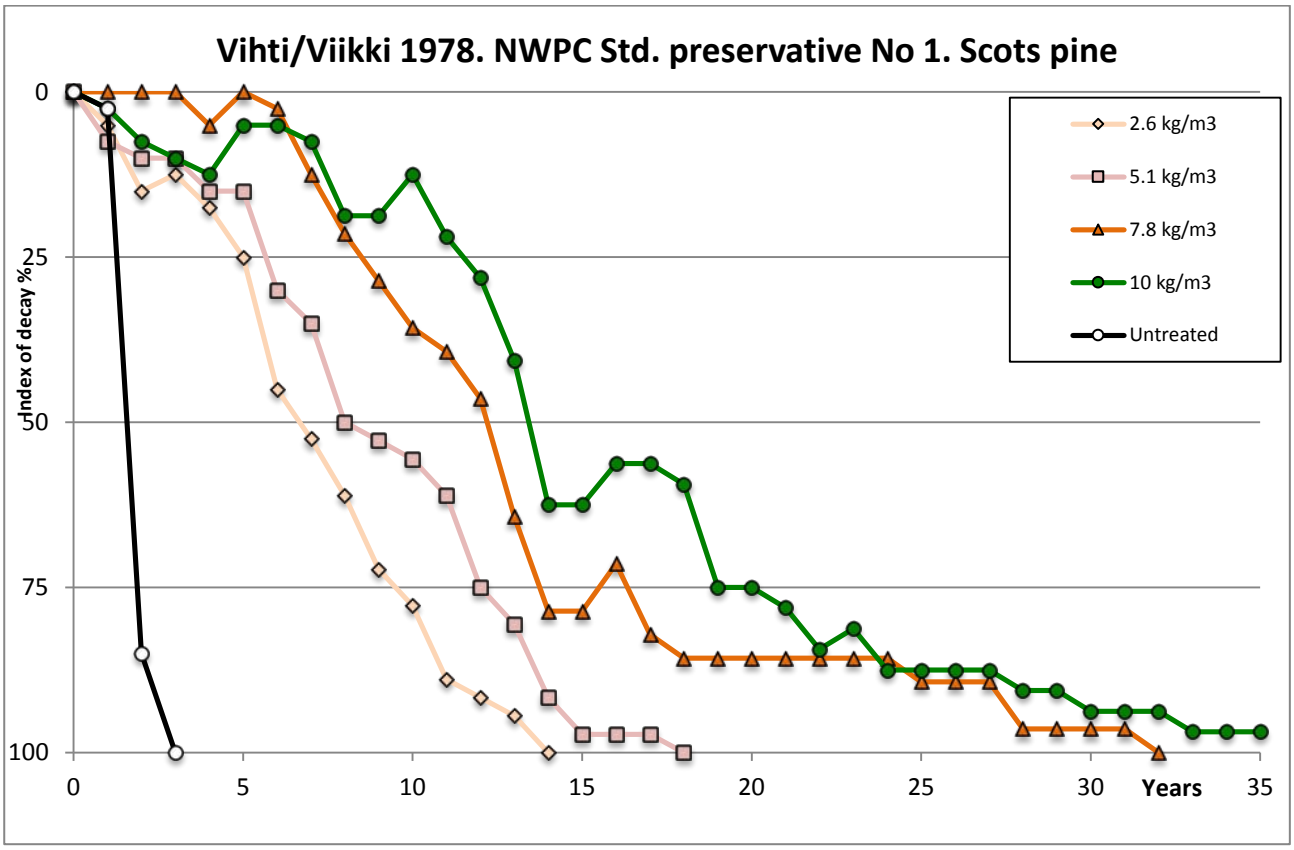
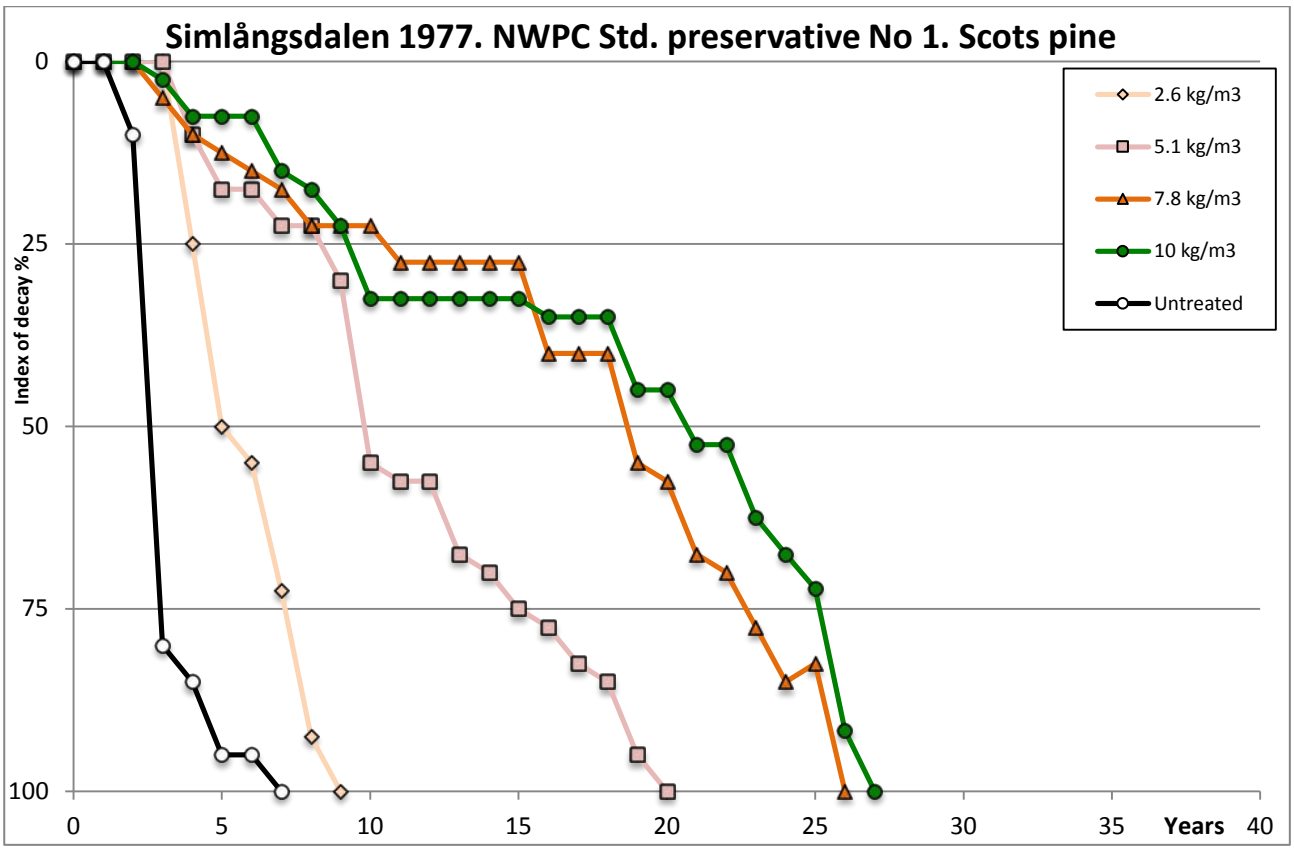


Figure 51. Field trial 1977-78. Index of decay for stakes of Scots pine treated with NWPC Standard preservative No 1.



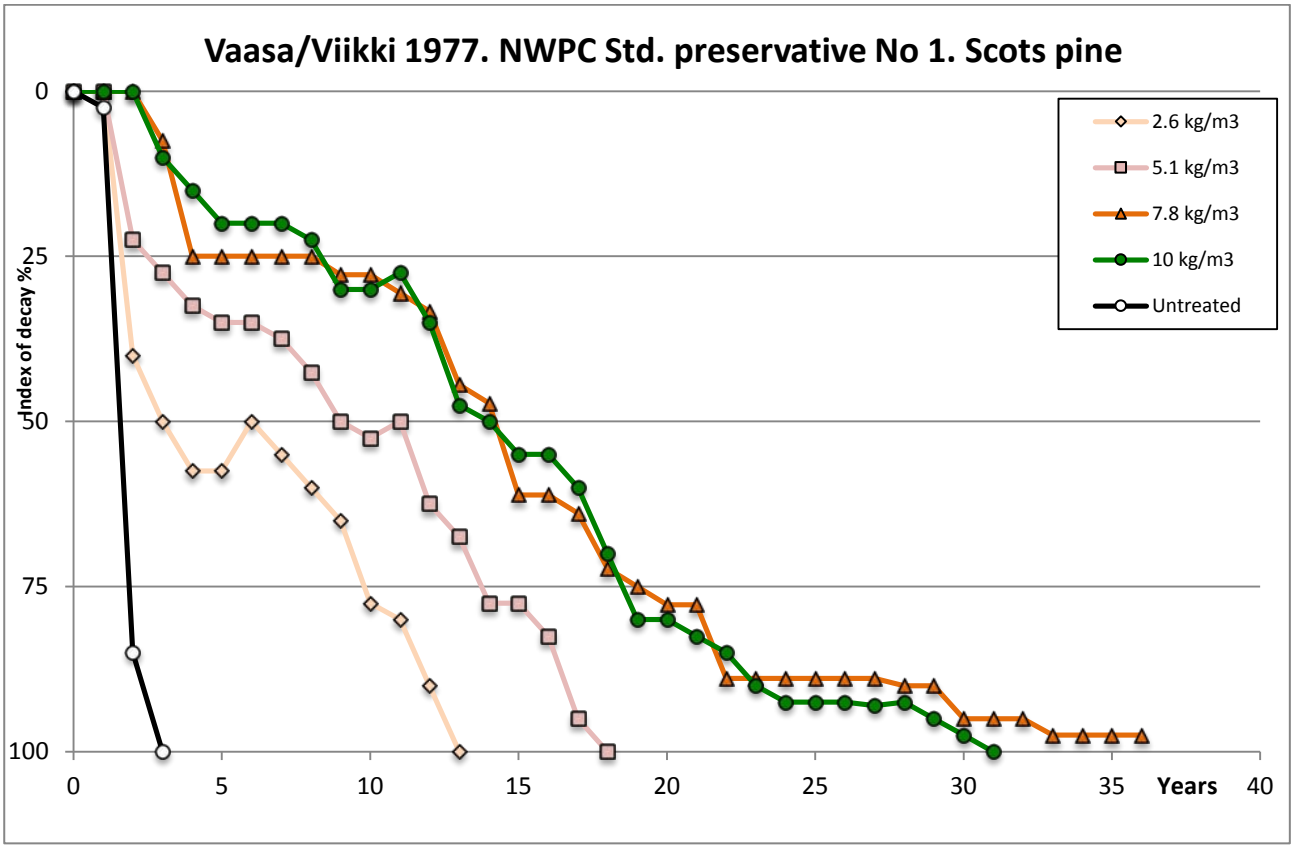
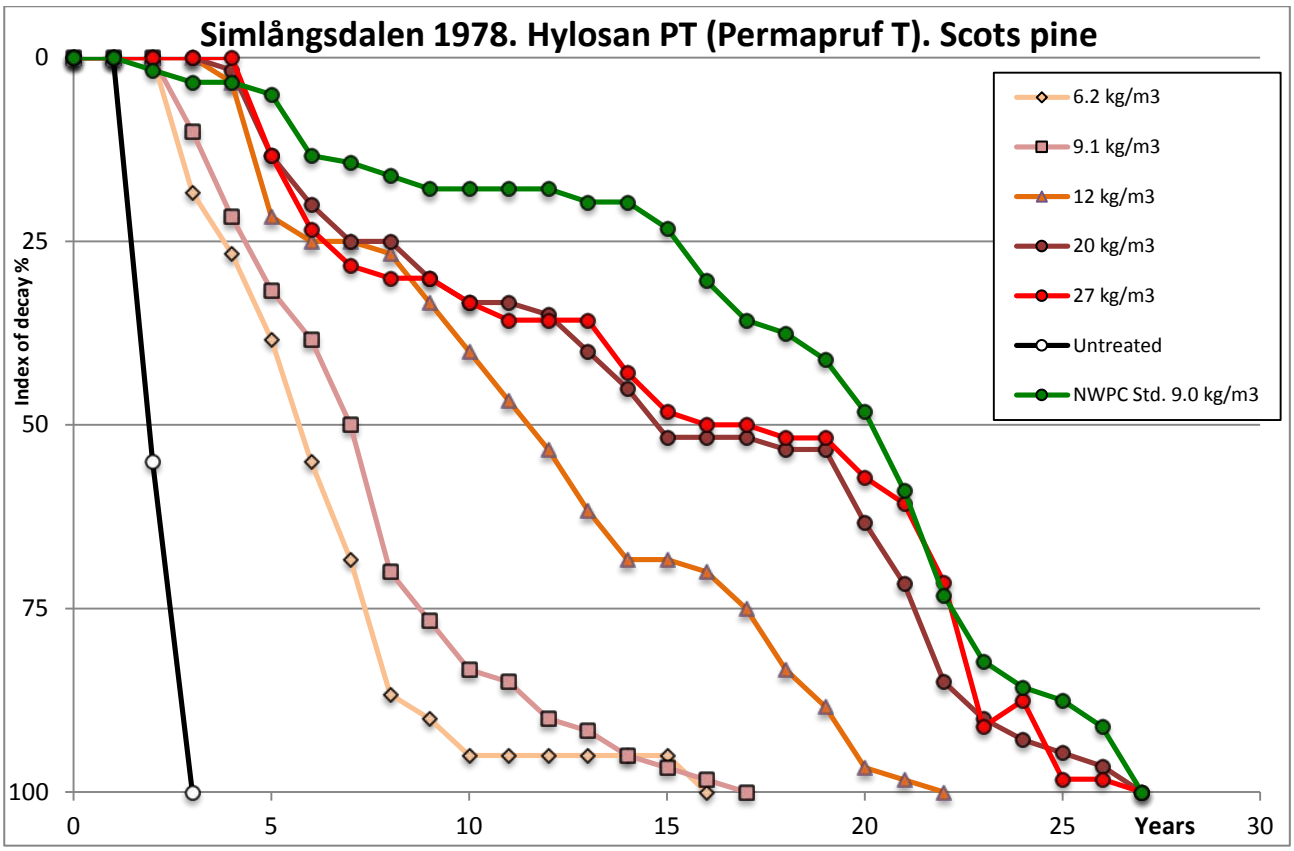


Figure 52. Field trial 1977-78. Index of decay for stakes of Scots pine treated with NWPC Standard preservative No 1.



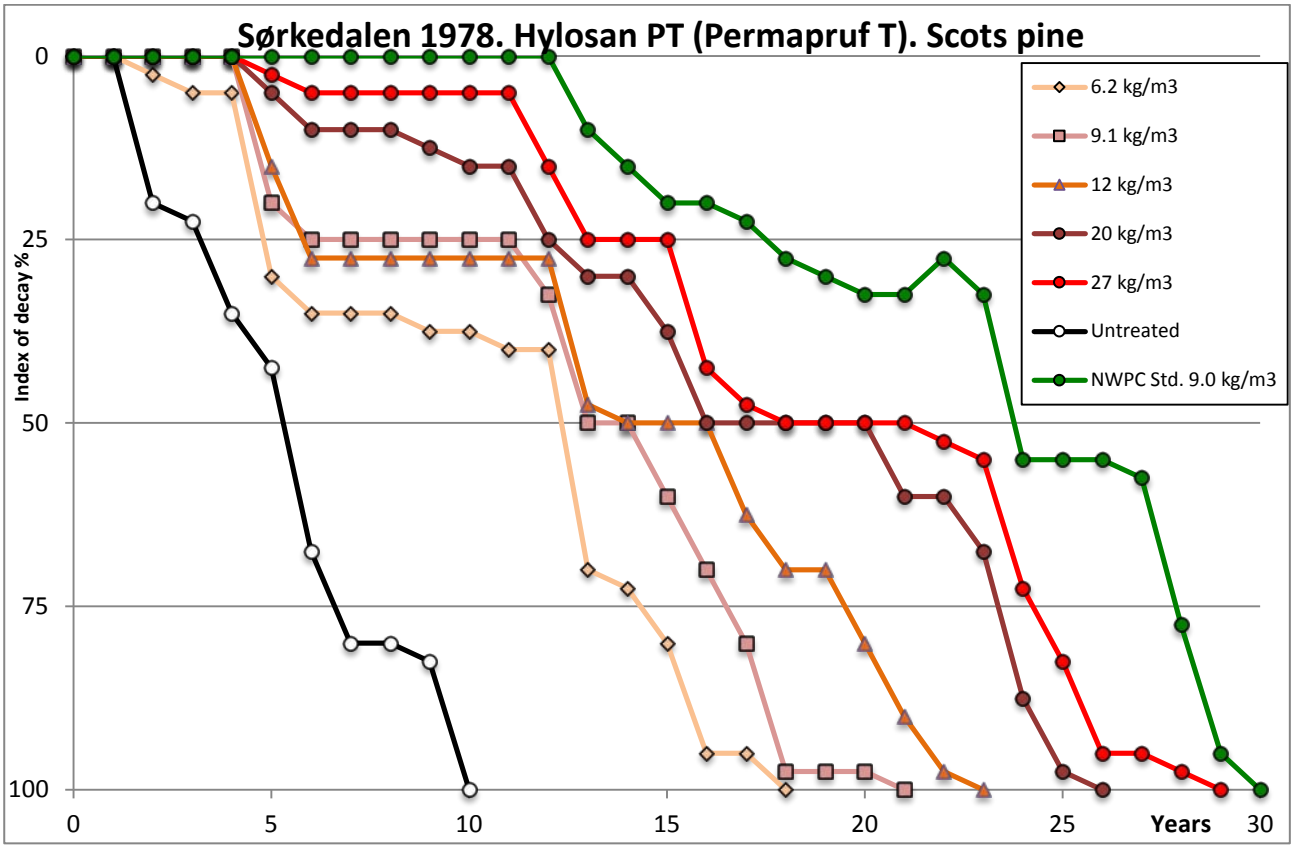
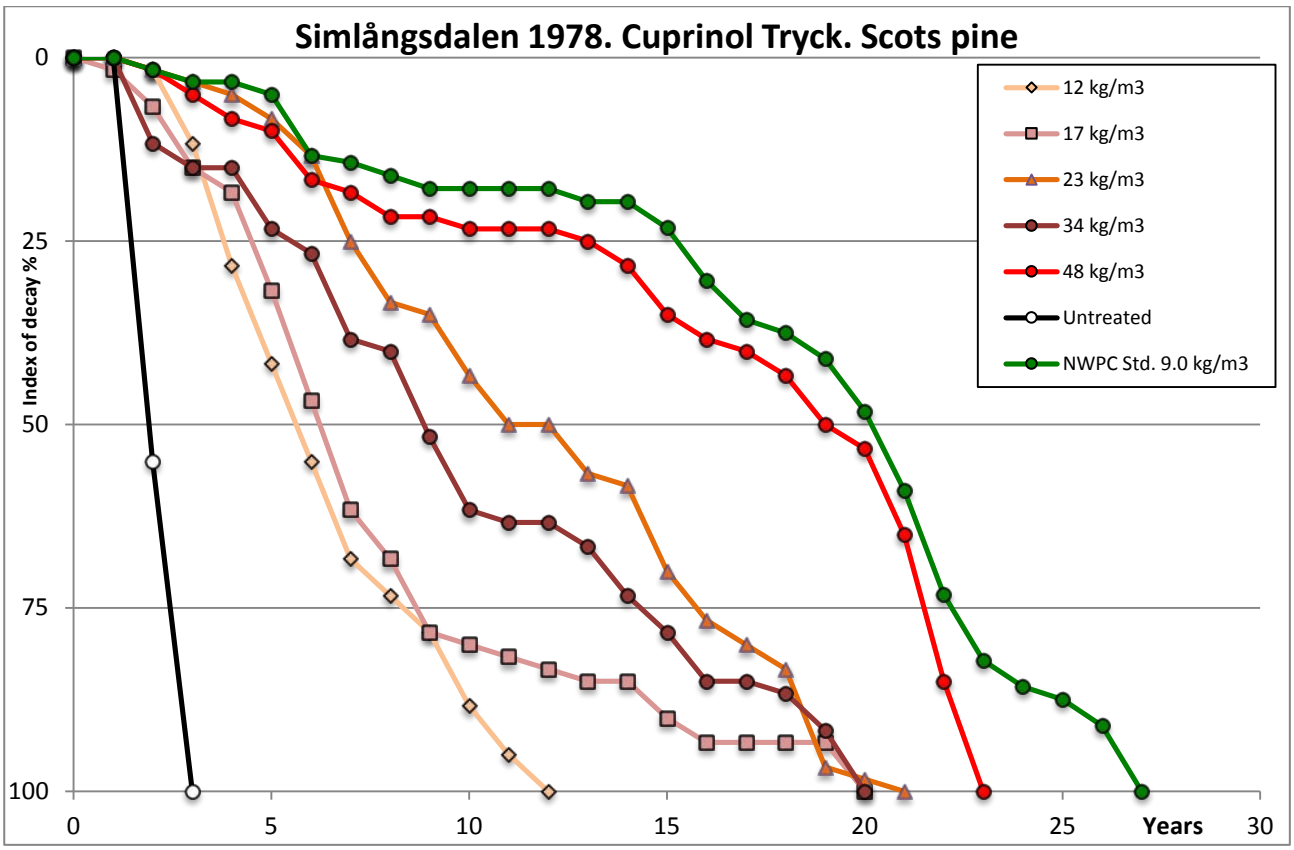


Figure 53. Field trial 1978. Index of decay for stakes of Scots pine treated with Hylosan PT (Permapruf T).



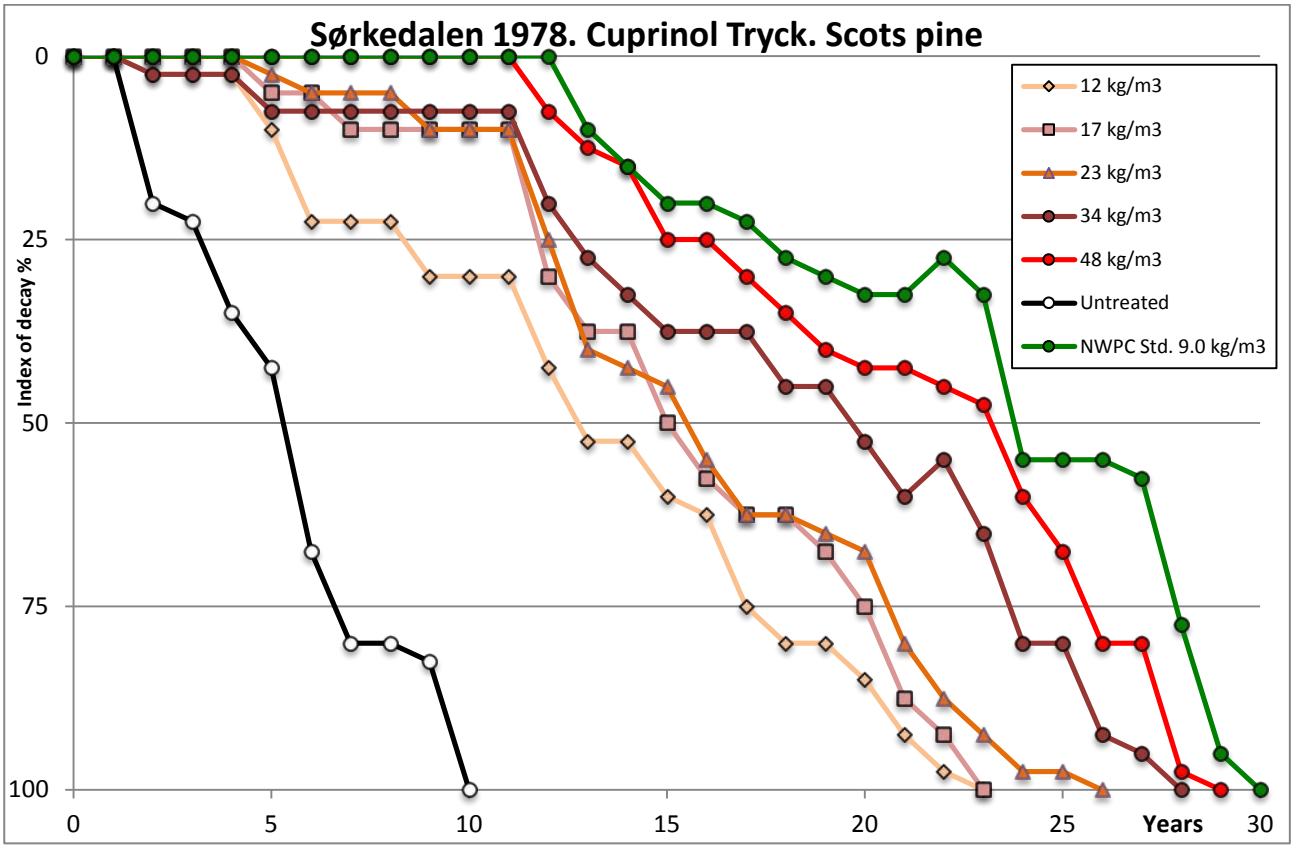
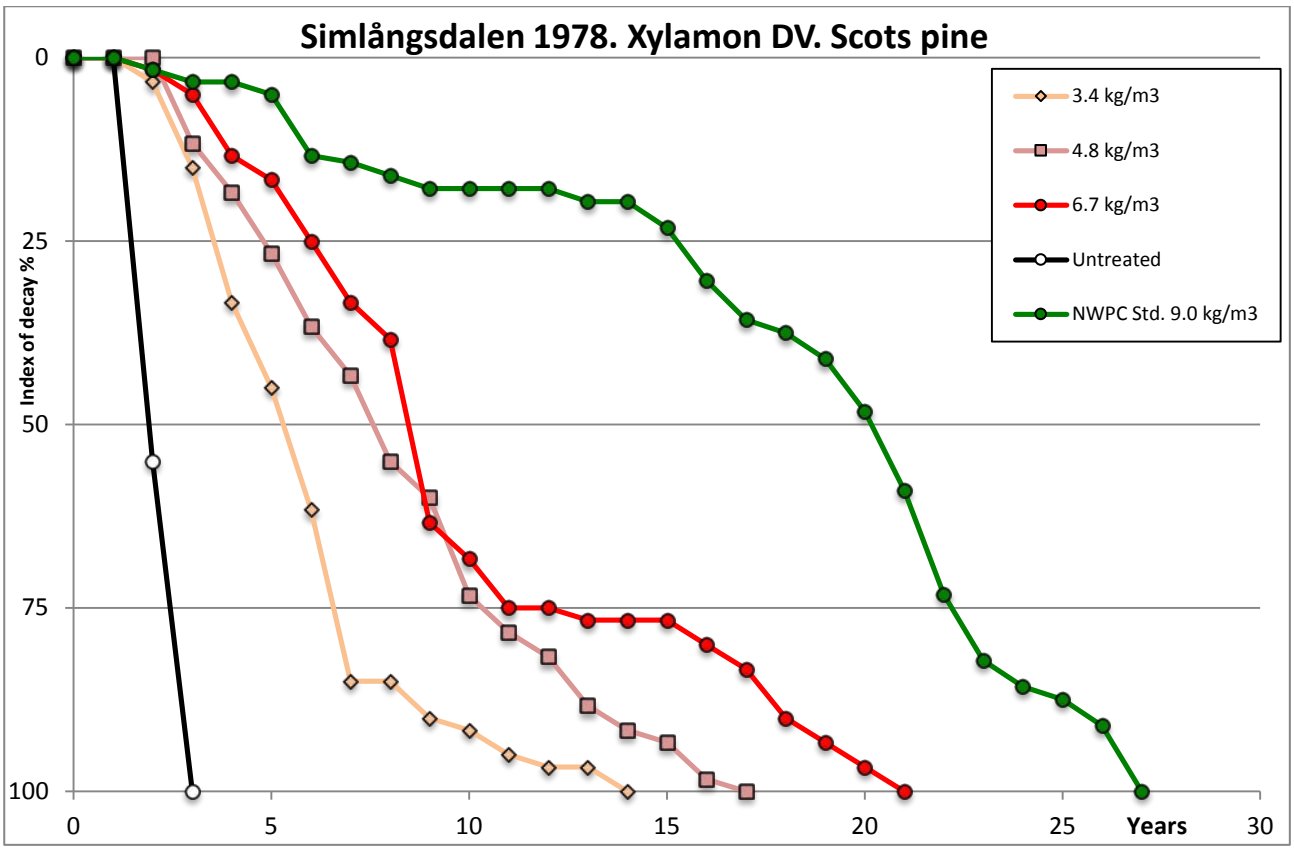


Figure 54. Field trial 1978. Index of decay for stakes of Scots pine treated with Cuprinol Tryck.



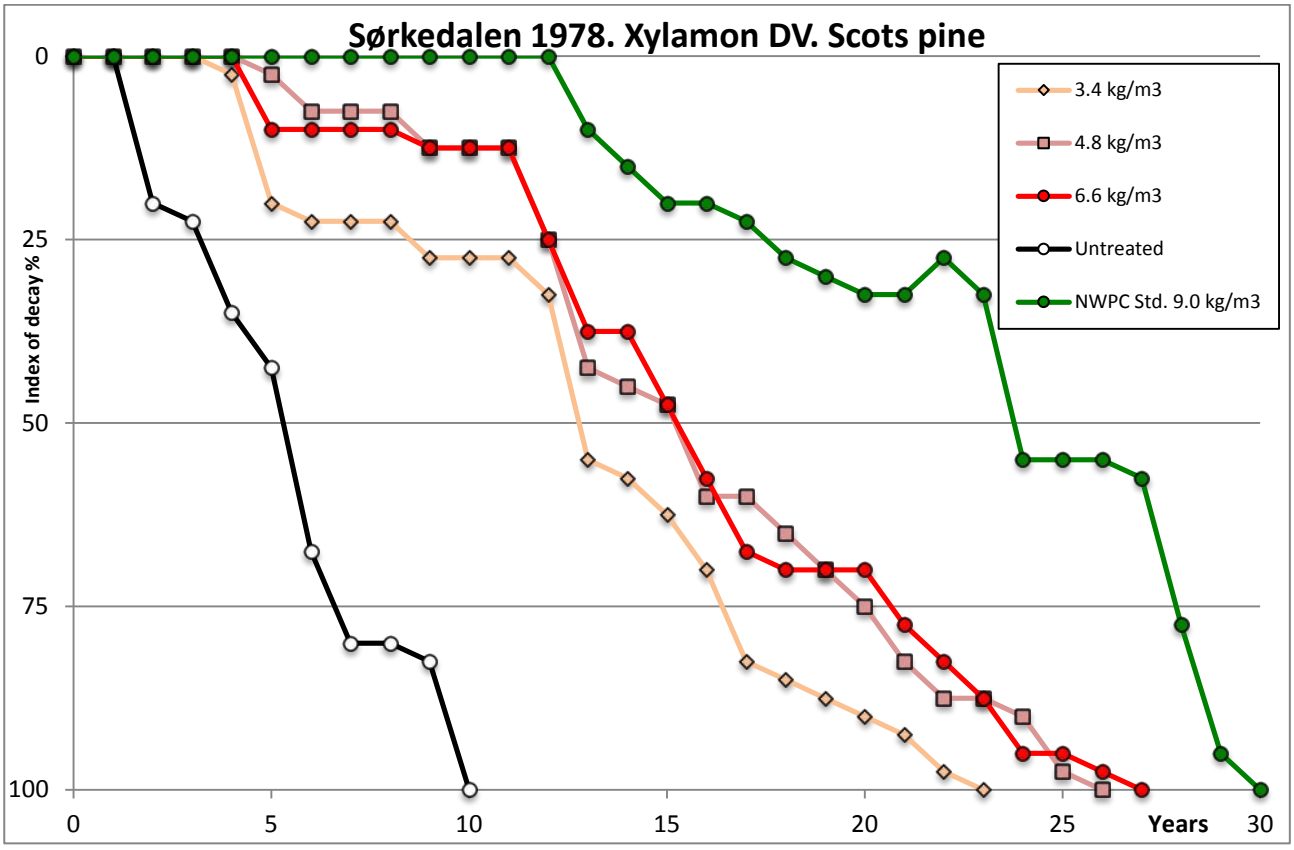
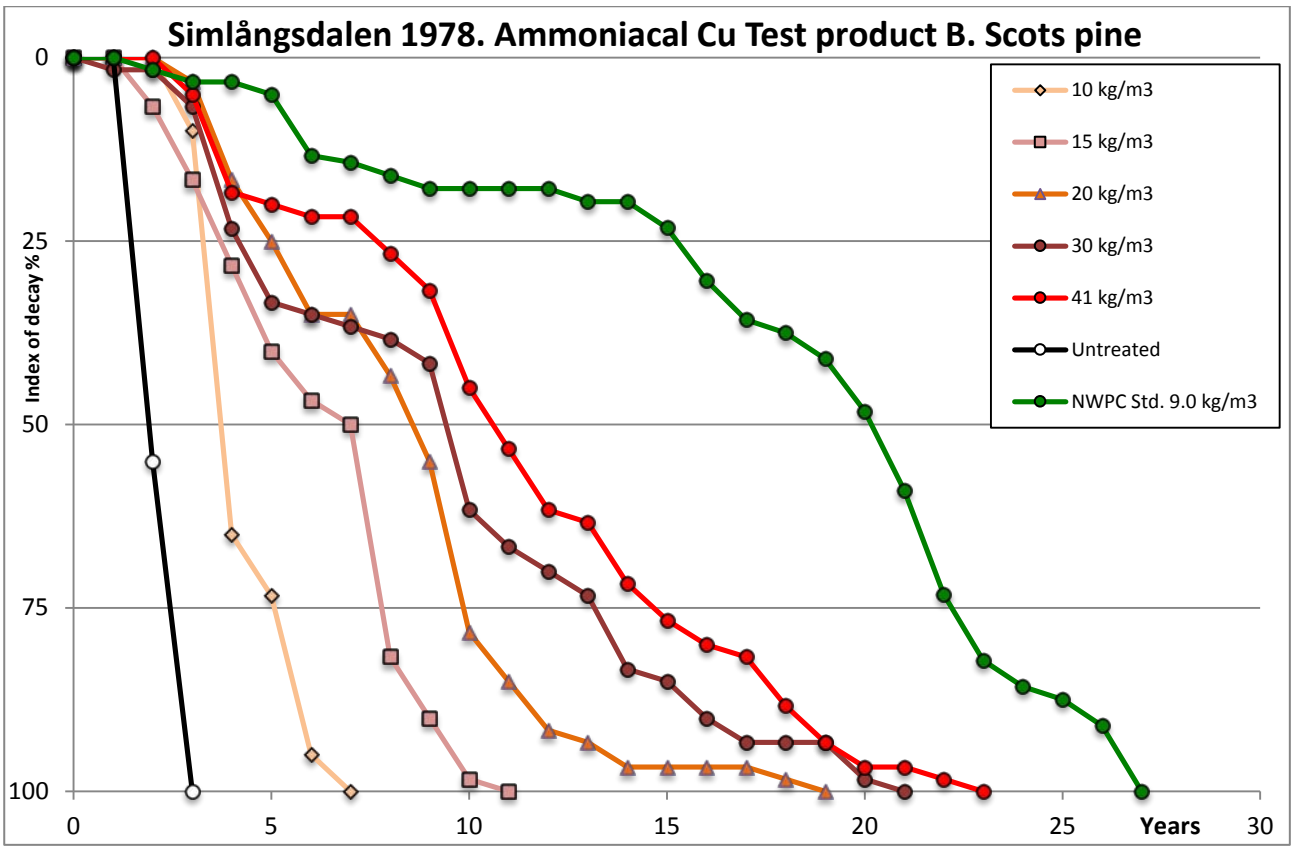


Figure 55. Field trial 1978. Index of decay for stakes of Scots pine treated with Xylamon DV.



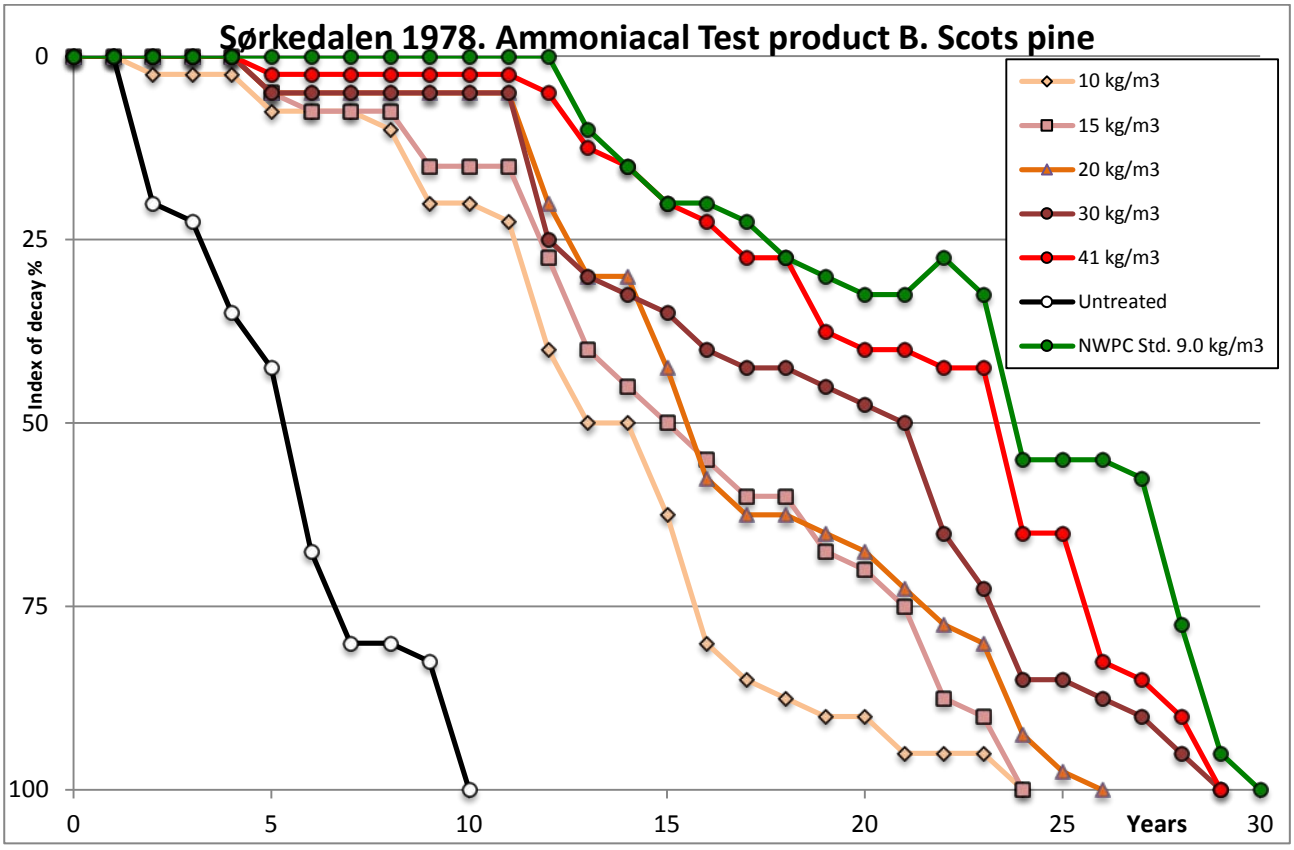
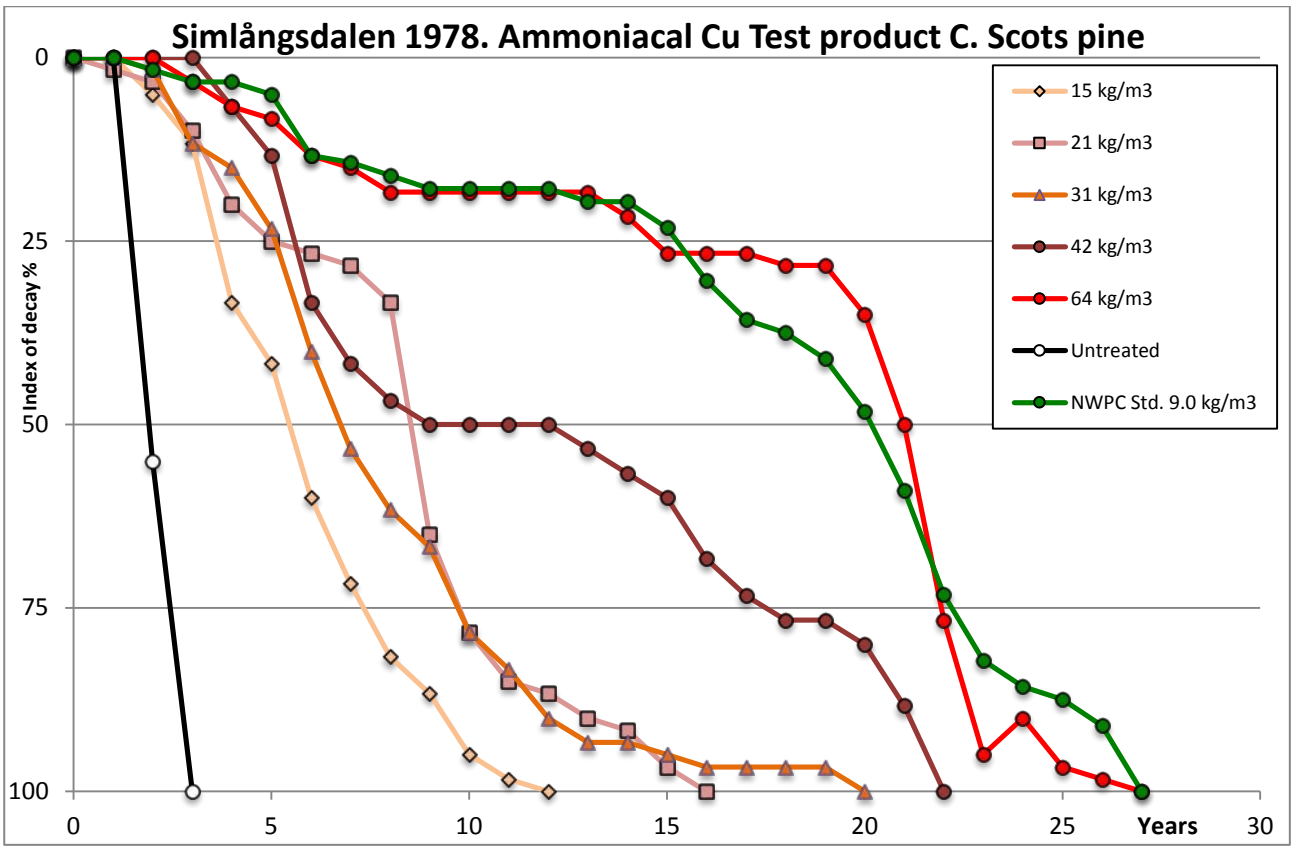


Figure 56. Field trial 1978. Index of decay for stakes of Scots pine treated with Ammoniacal Cu Test product B.



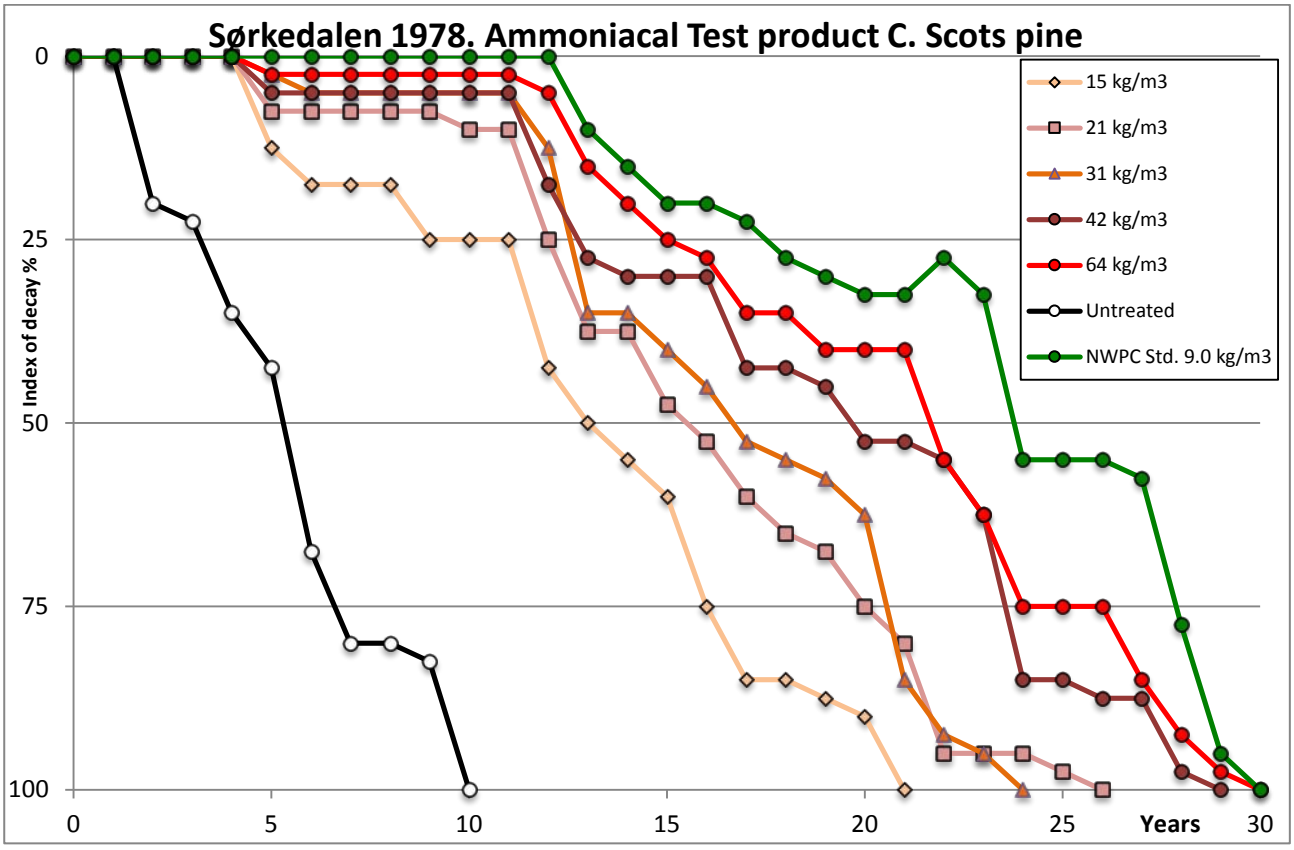
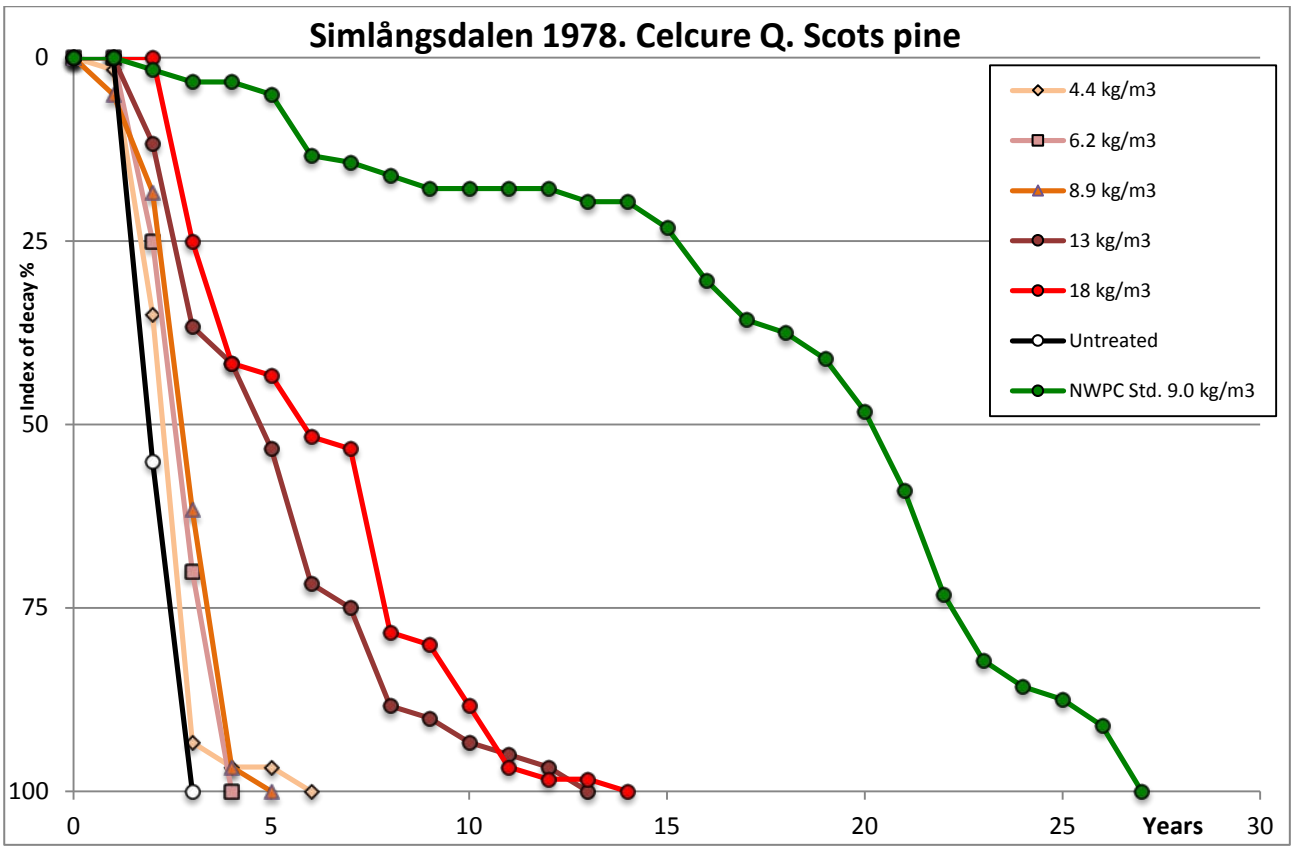


Figure 57. Field trial 1978. Index of decay for stakes of Scots pine treated with Ammoniacal Cu Test product C.



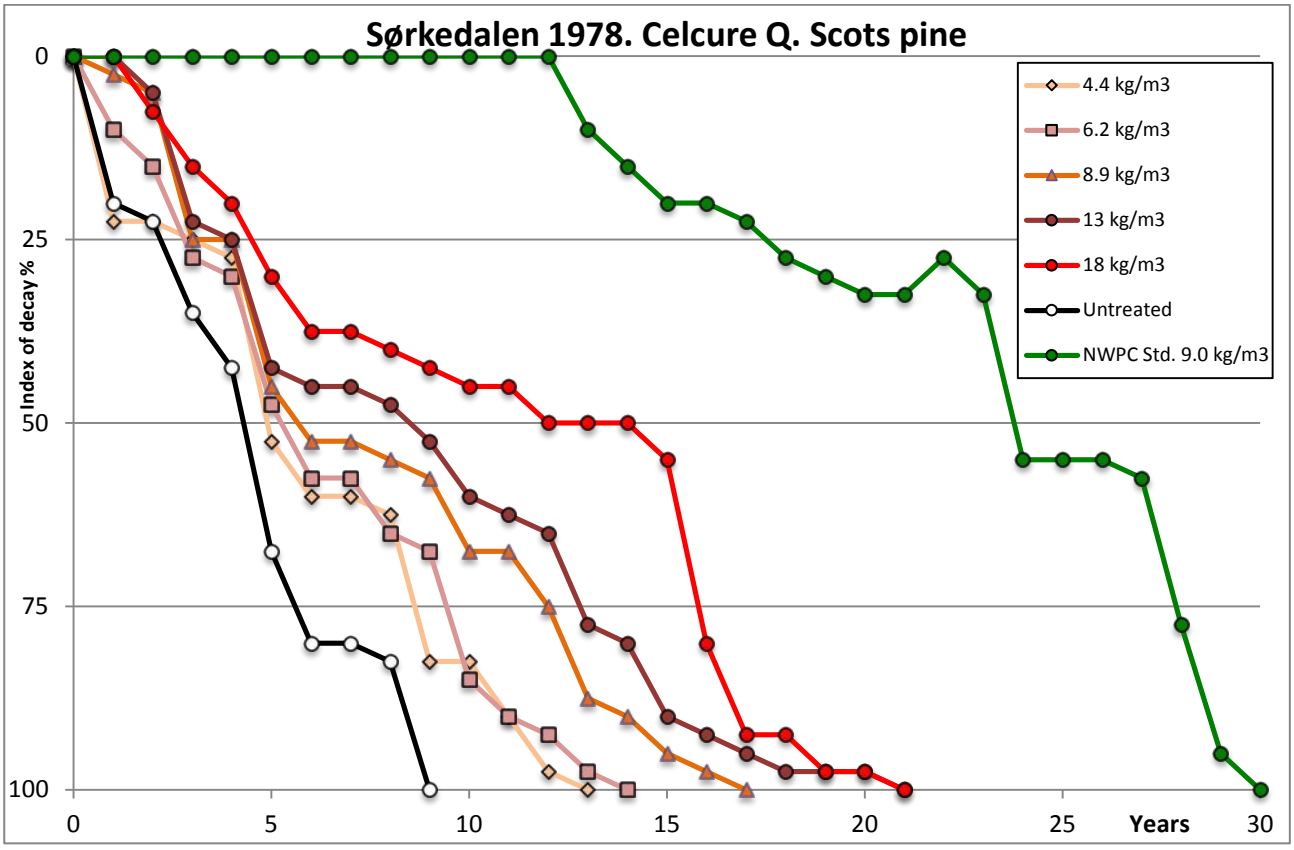
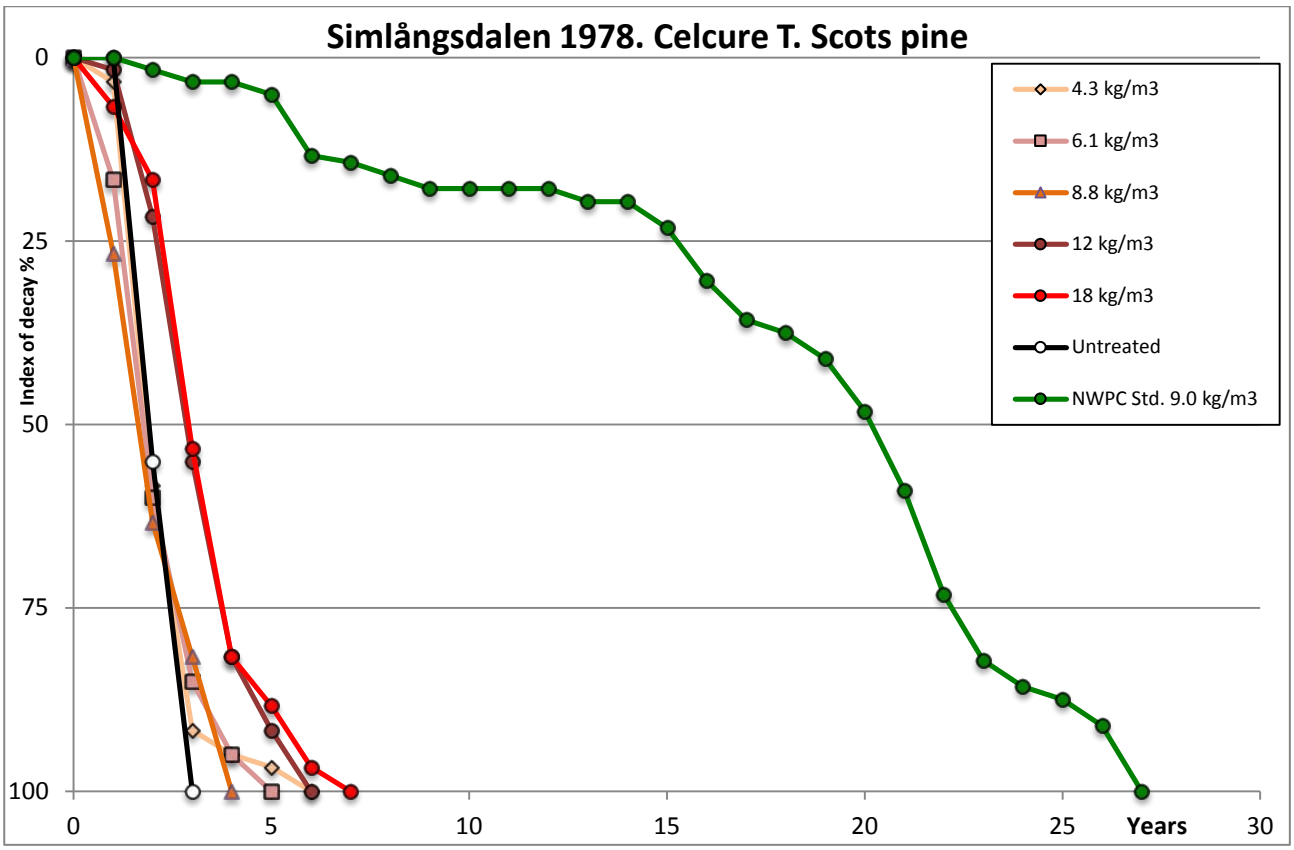


Figure 58. Field trial 1978. Index of decay for stakes of Scots pine treated with Celcure Q.



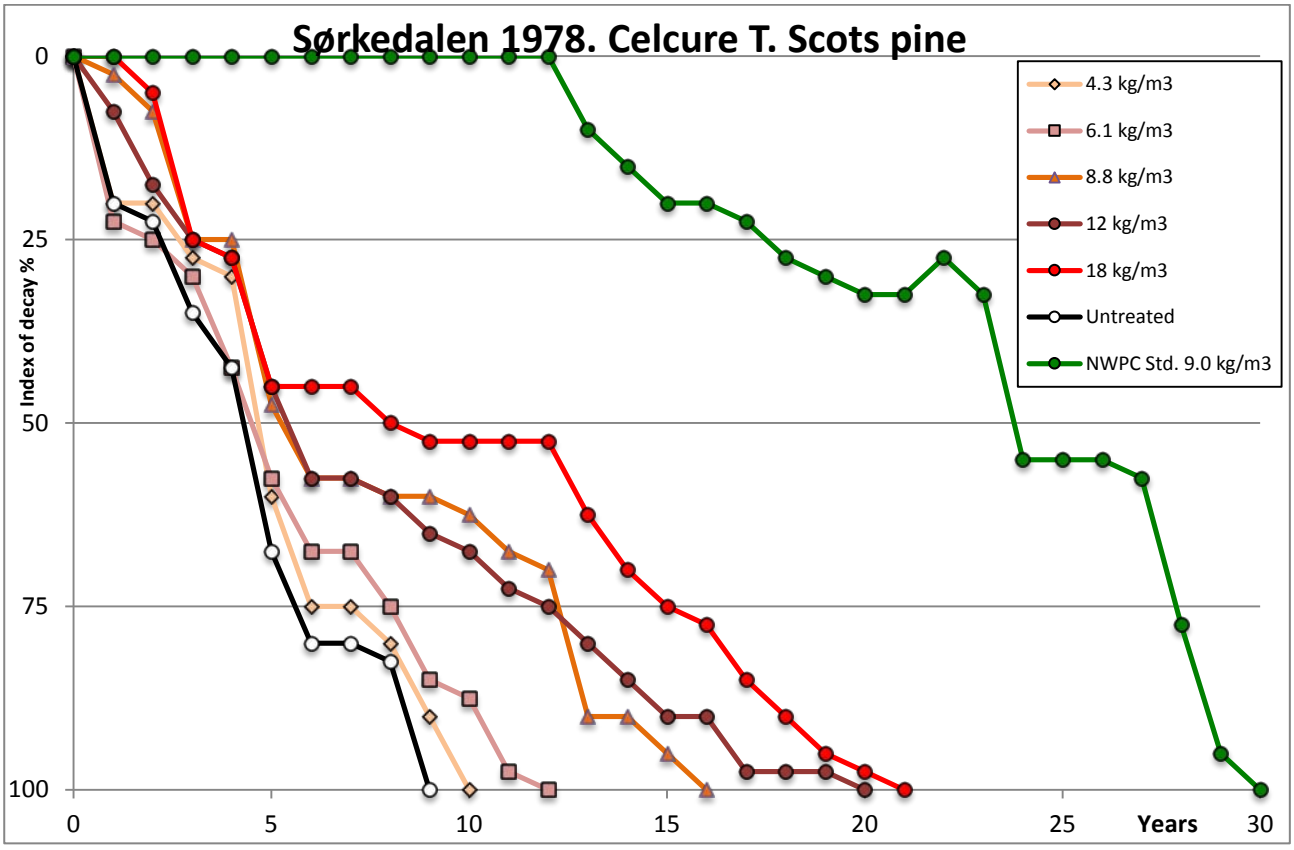
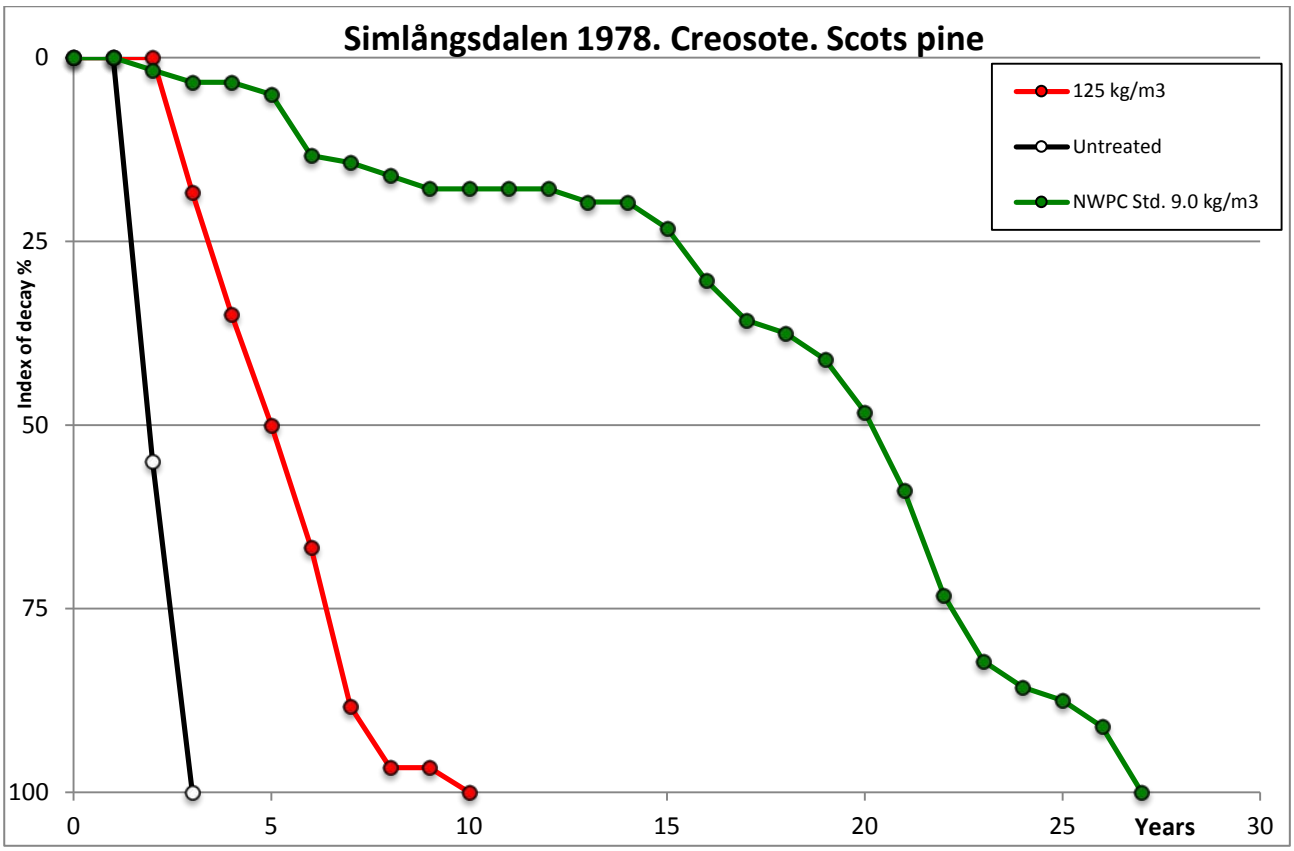


Figure 59. Field trial 1978. Index of decay for stakes of Scots pine treated with Celcure T.



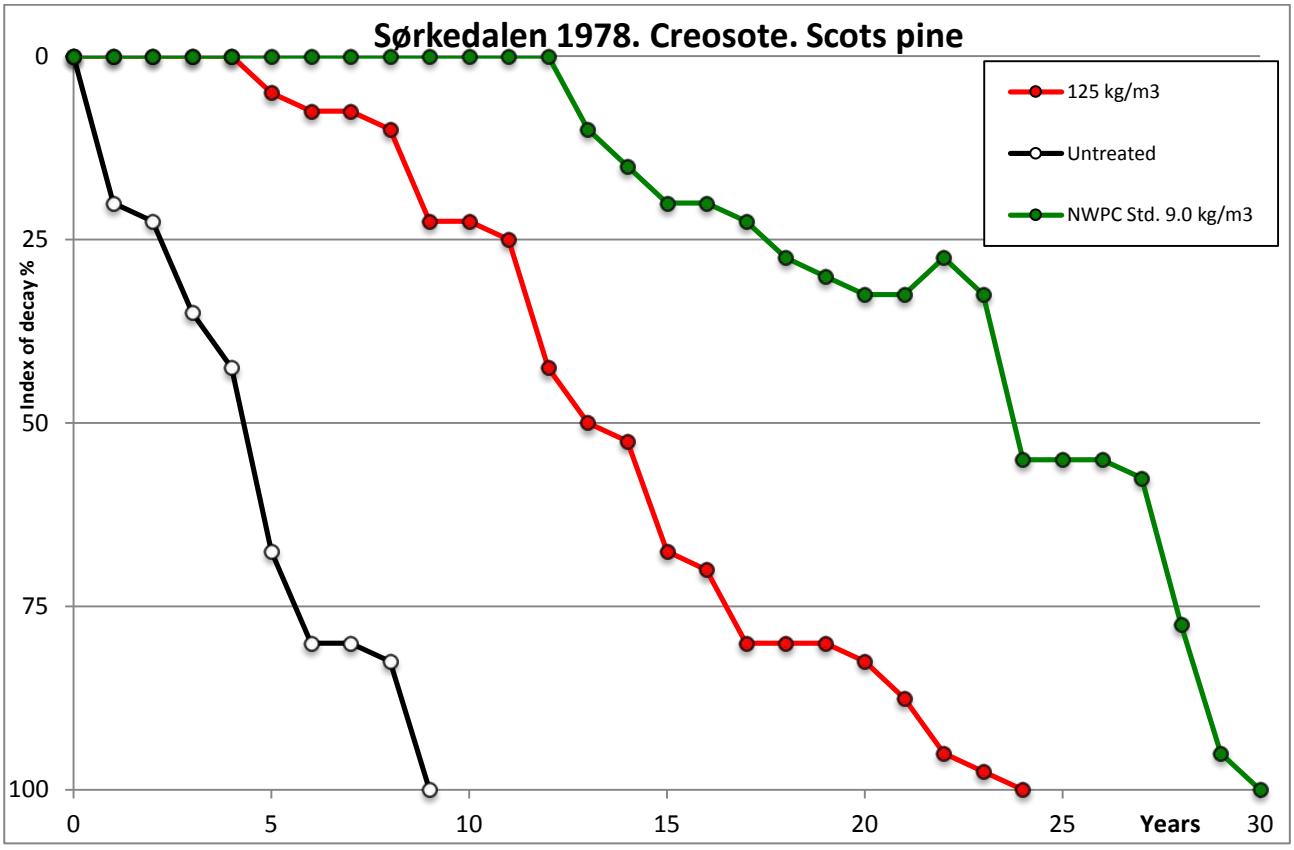
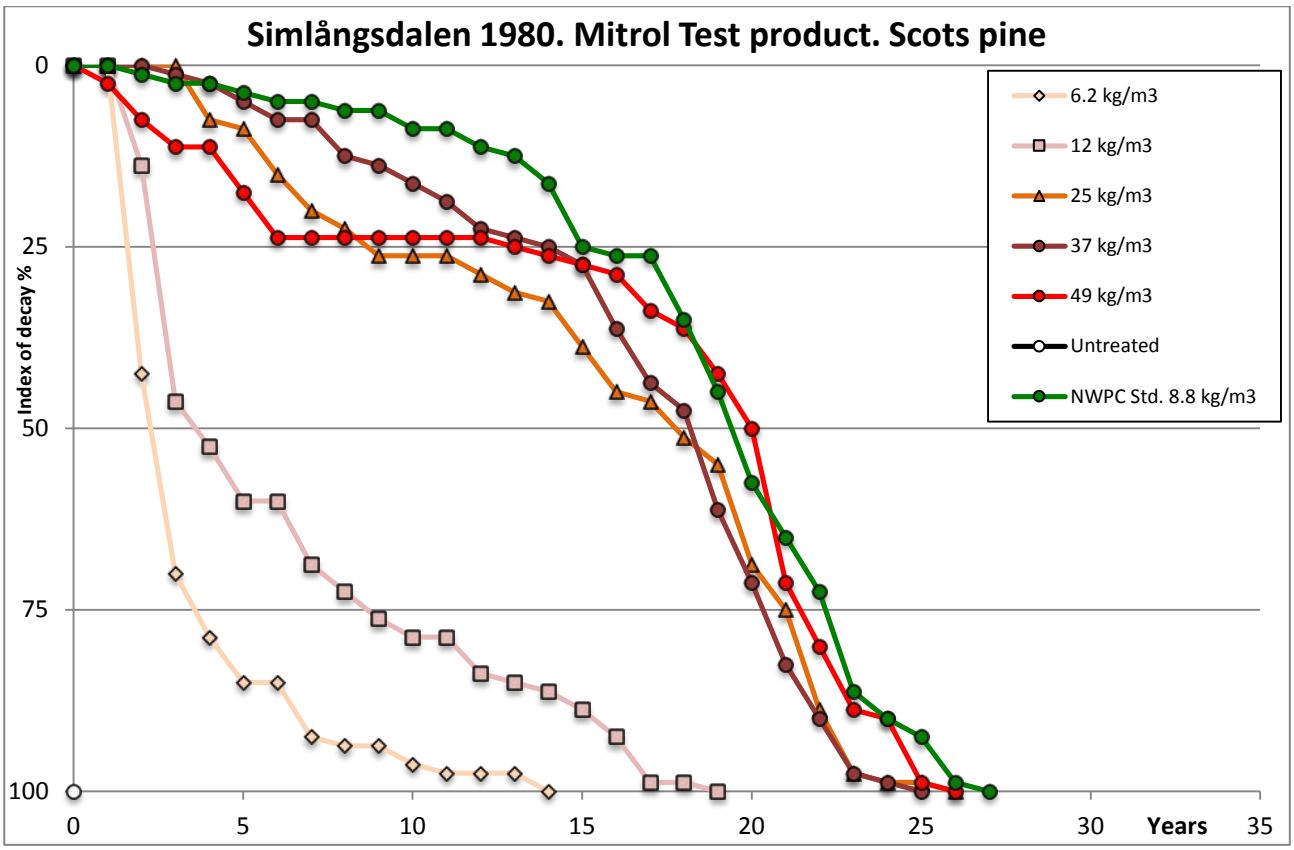


Figure 60. Field trial 1978. Index of decay for stakes of Scots pine treated with Creosote.



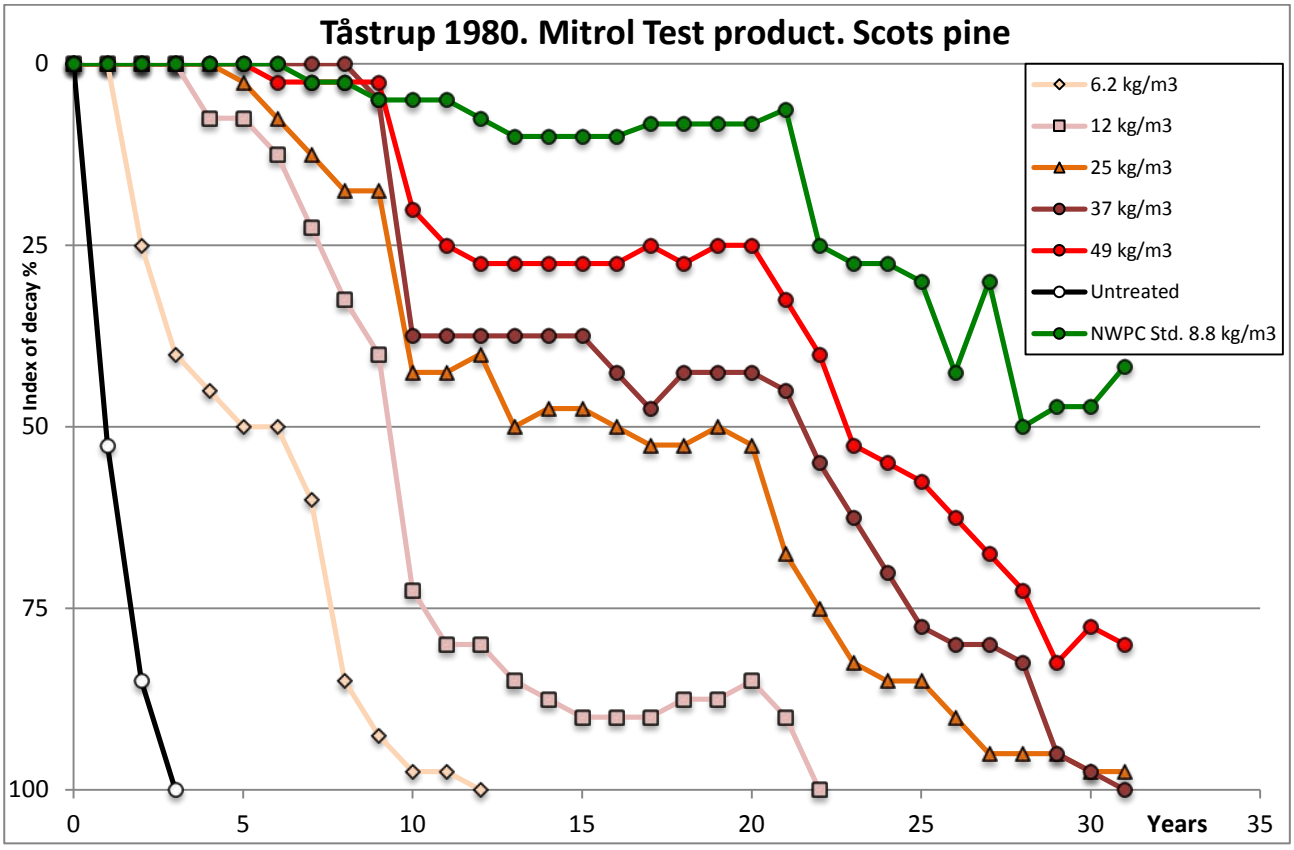
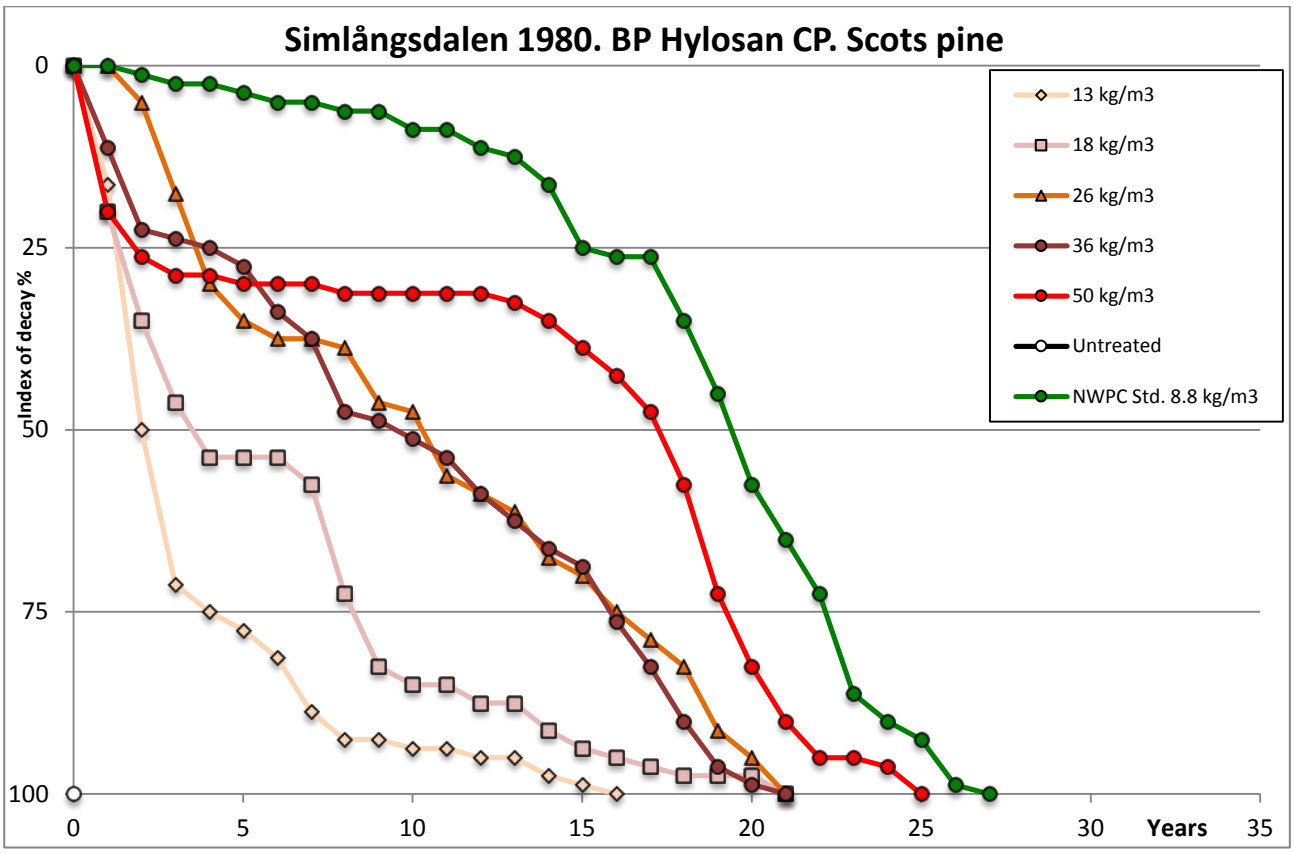


Figure 61. Field trial 1980:1. Index of decay for stakes of Scots pine treated with Mitrol Test product.



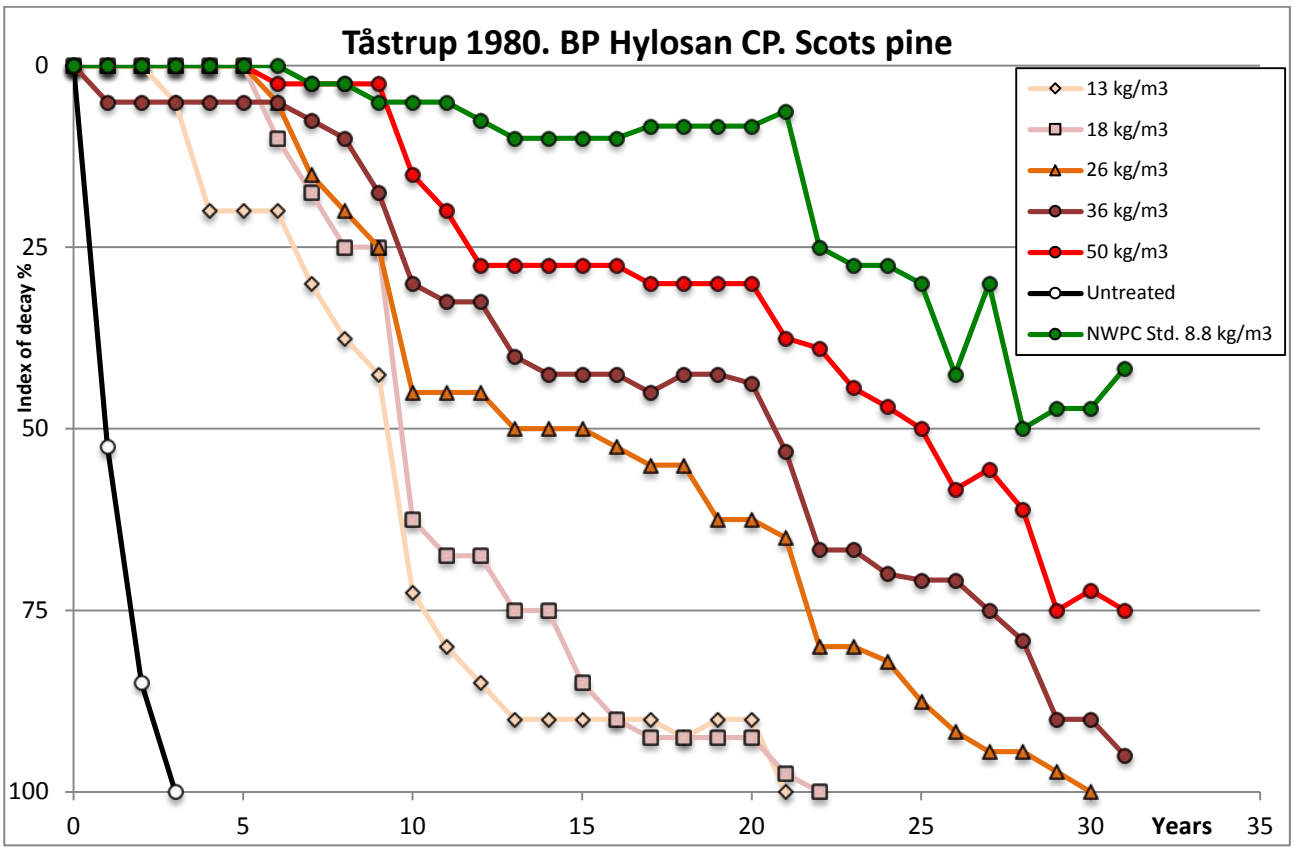
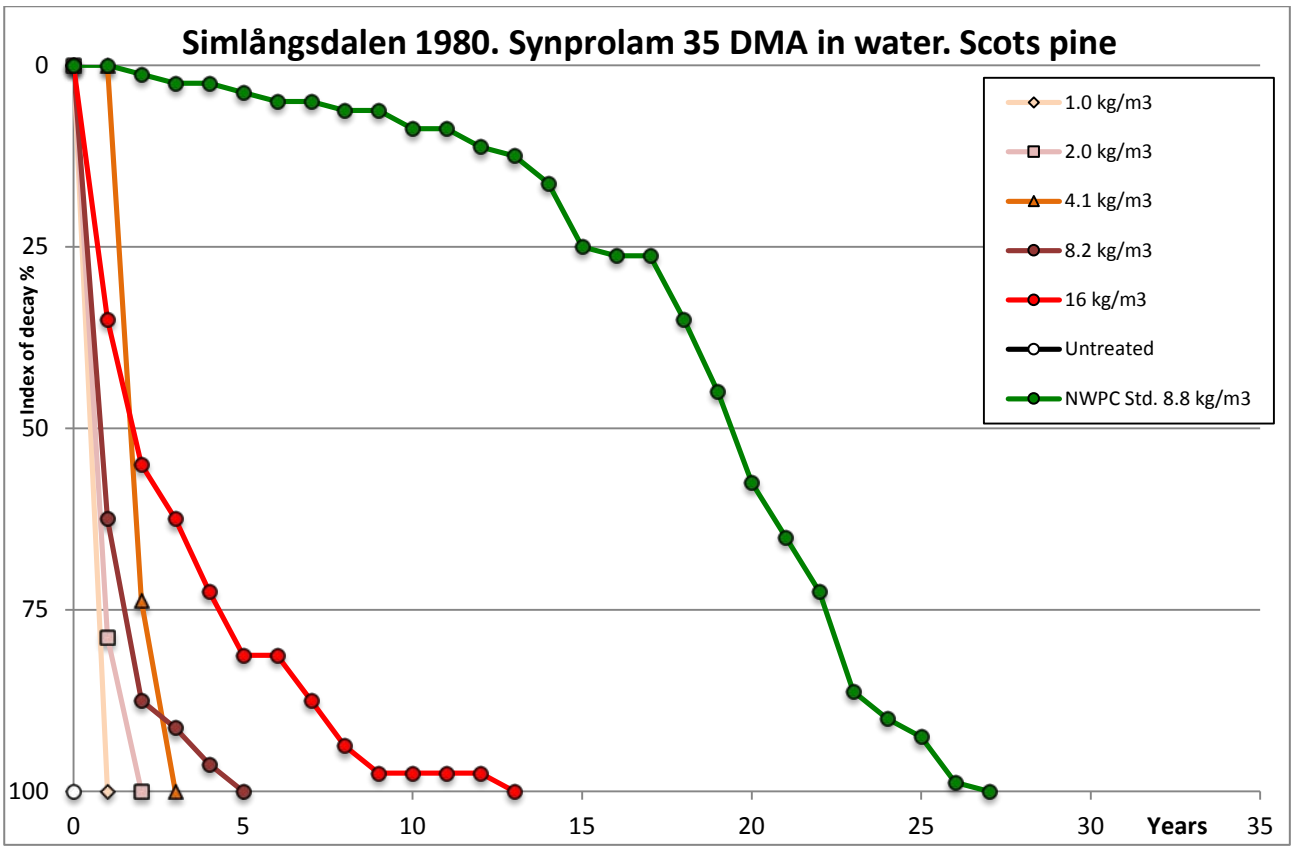


Figure 62. Field trial 1980:1. Index of decay for stakes of Scots pine treated with BP Hylosan CP.



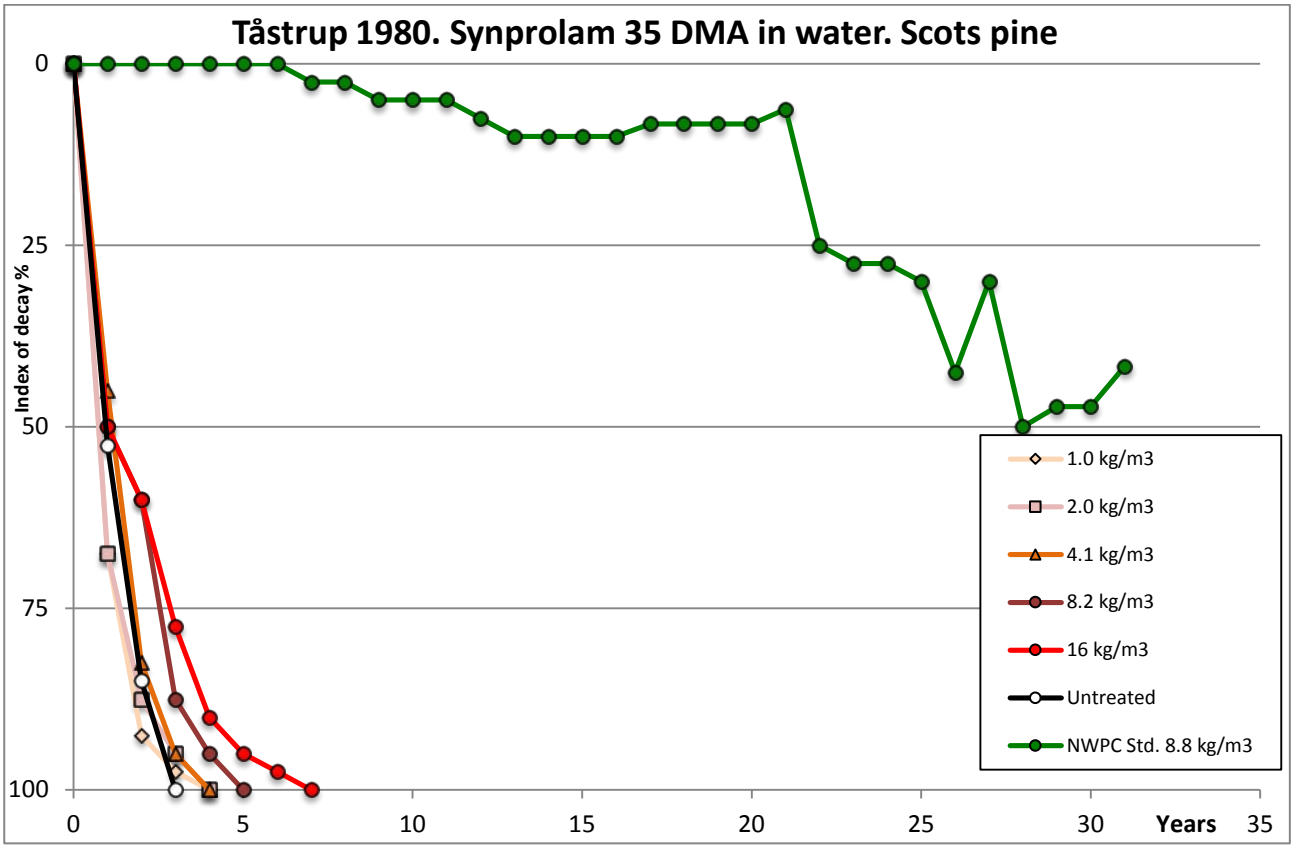
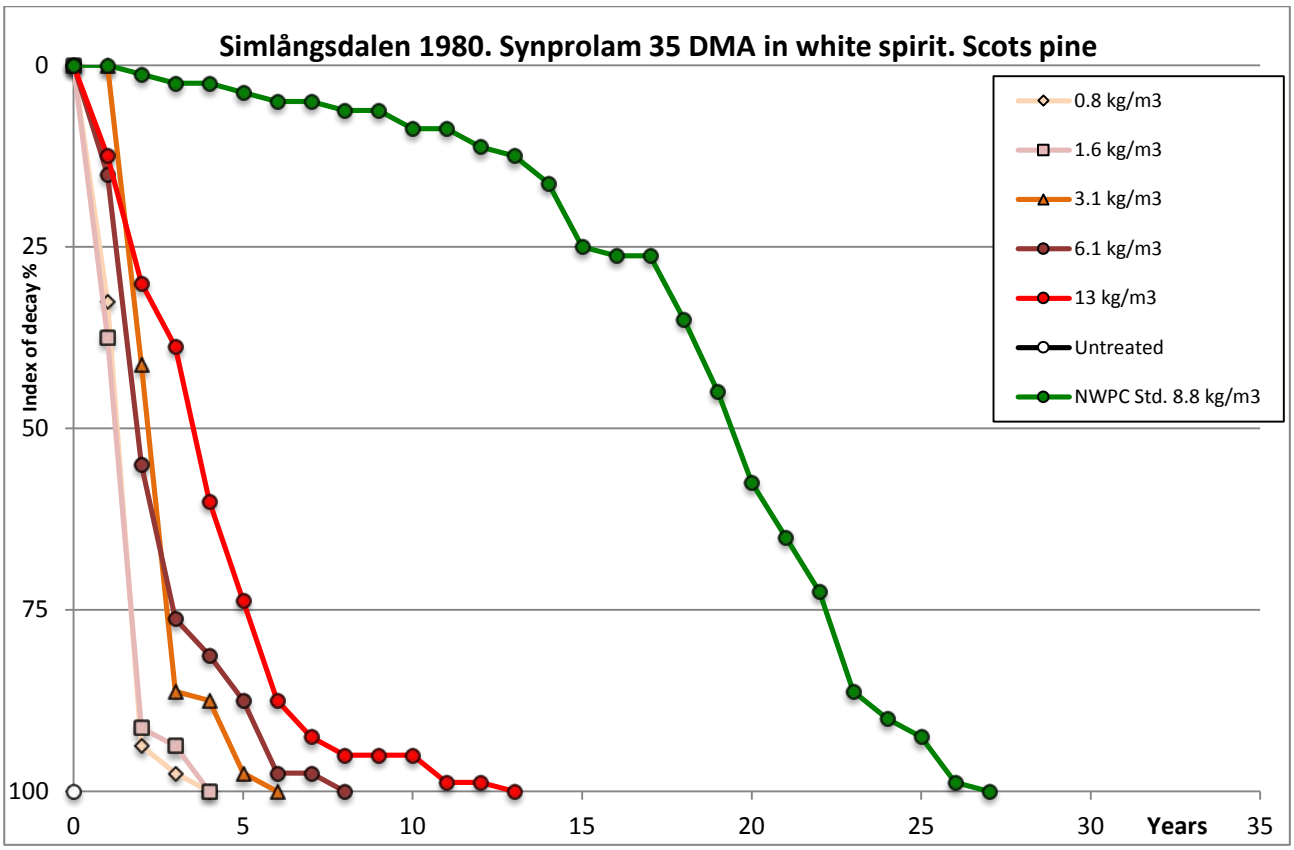


Figure 63. Field trial 1980:1. Index of decay for stakes of Scots pine treated with Synprolam 35 DMA in water.



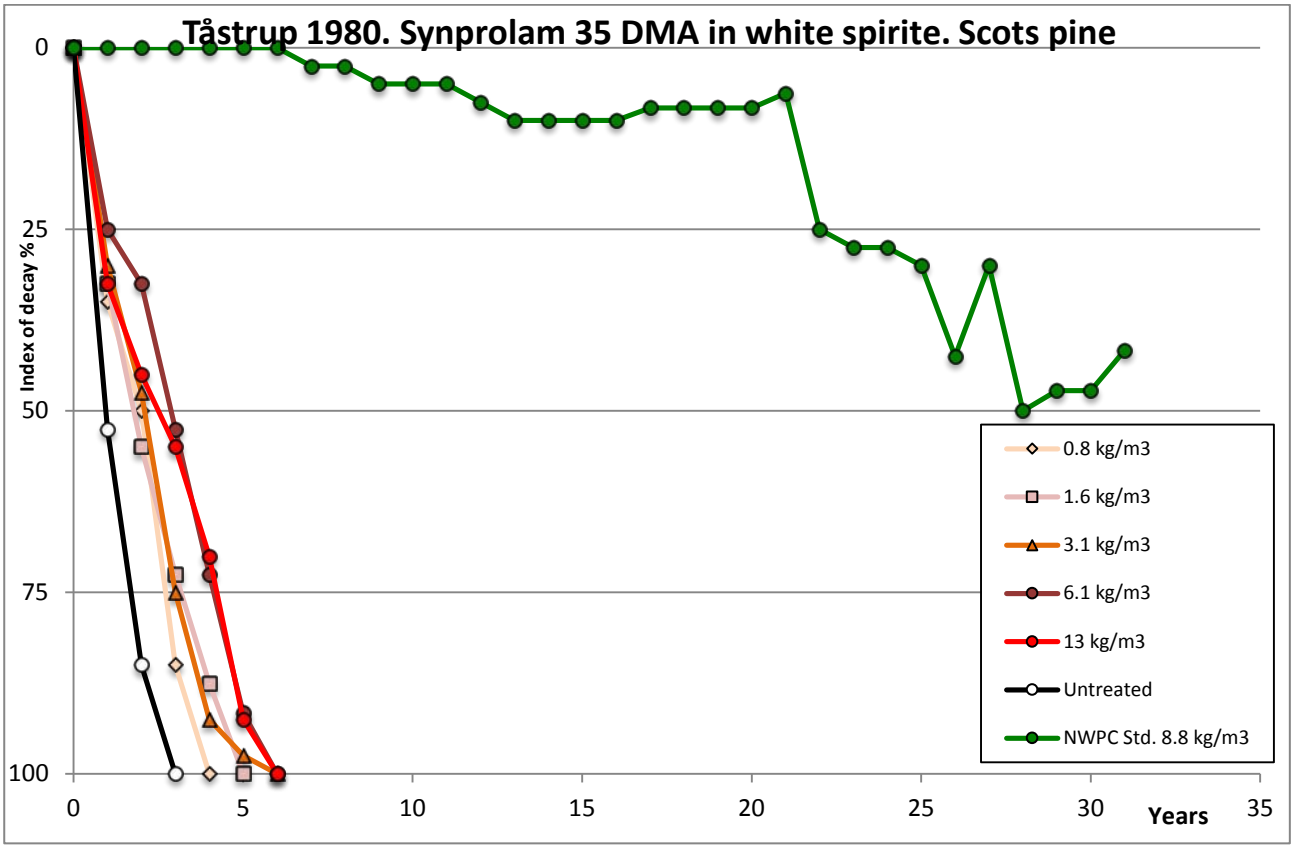
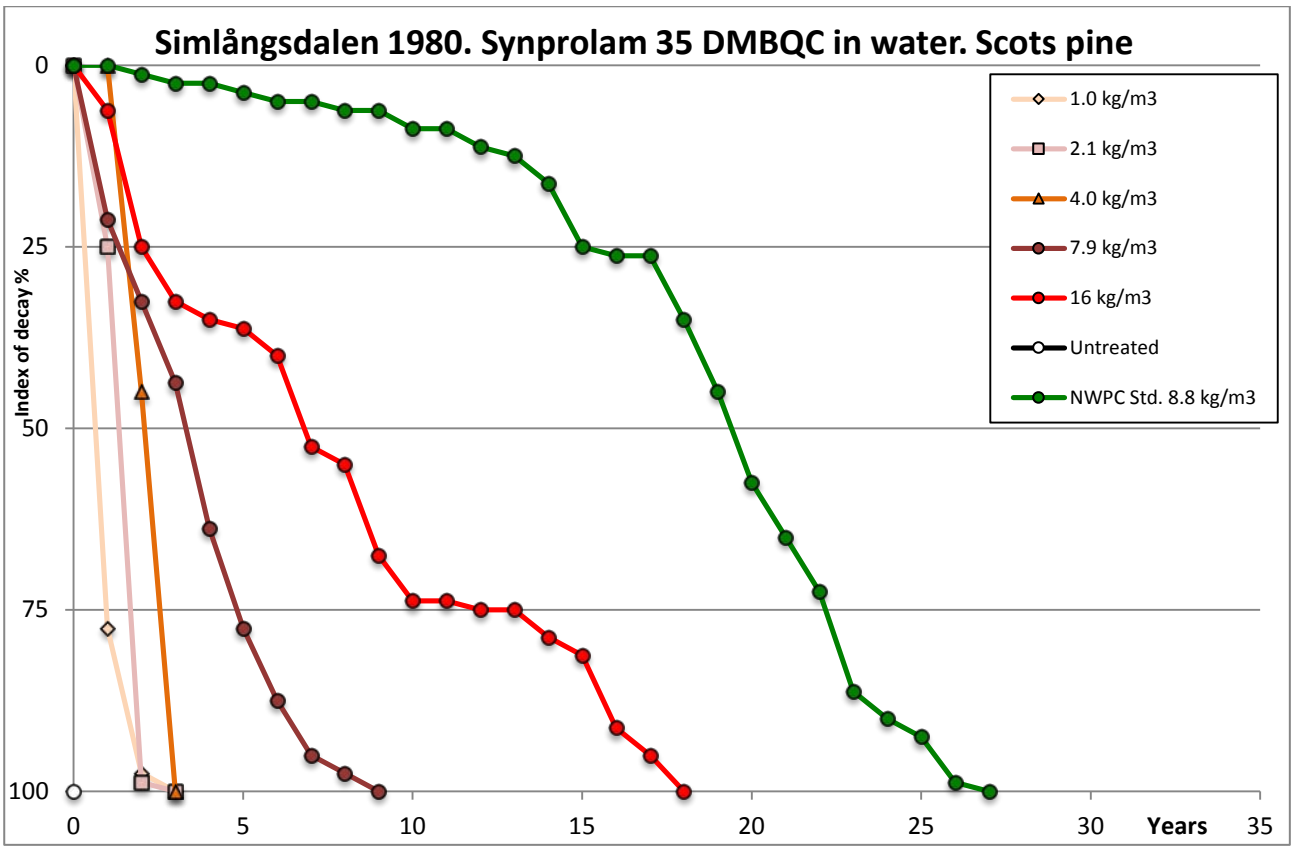


Figure 64. Field trial 1980:1. Index of decay for stakes of Scots pine treated with Synprolam 35 DMA in white spirit.



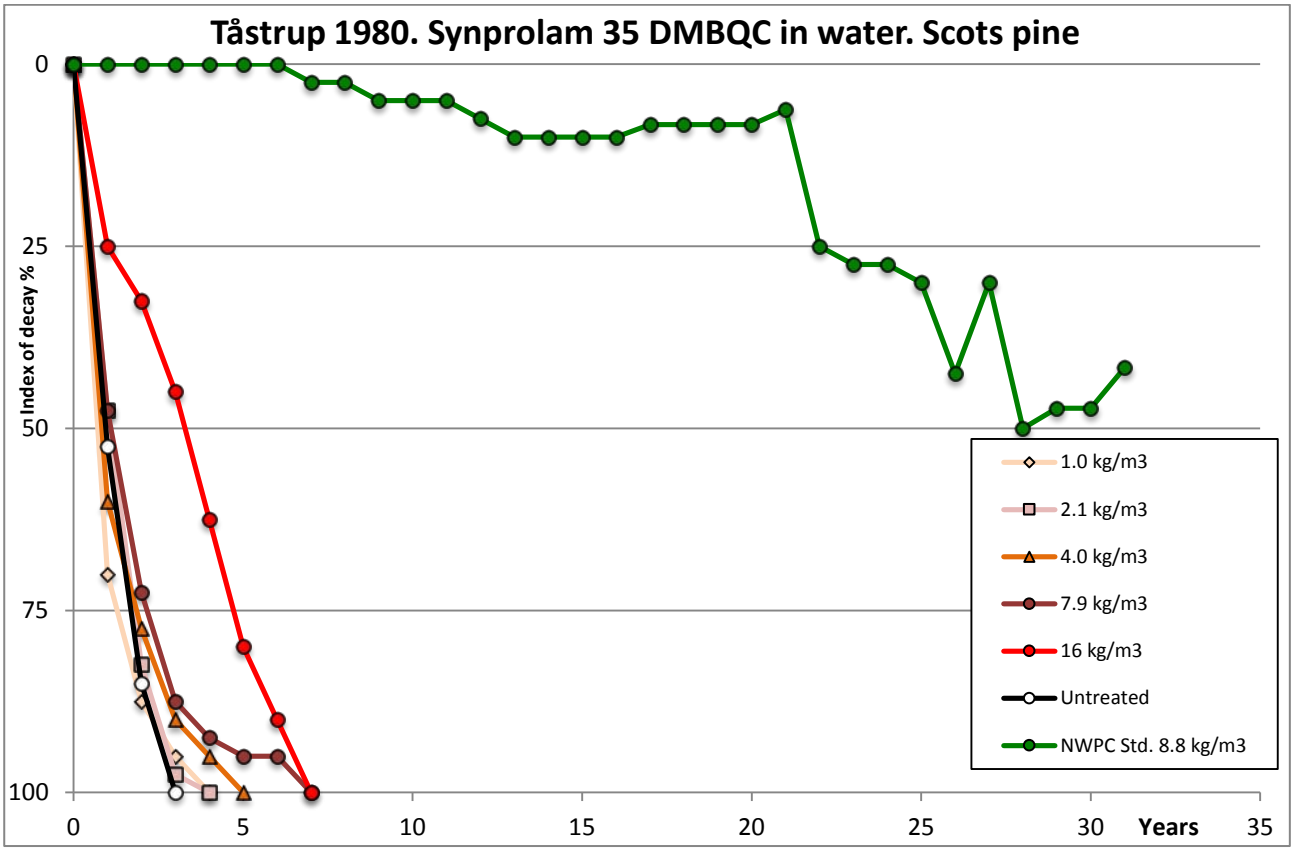
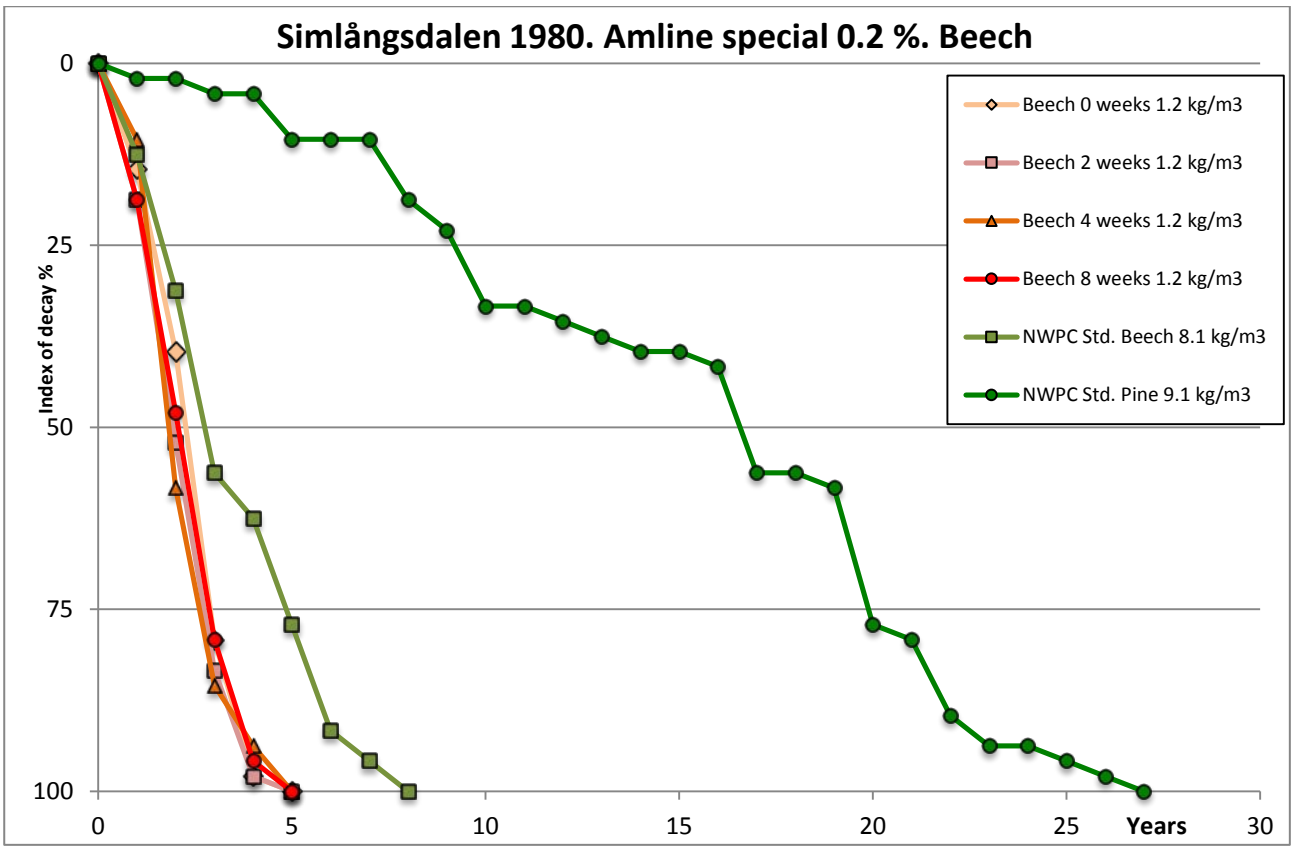


Figure 65. Field trial 1980:1. Index of decay for stakes of Scots pine treated with Synprolam 35 DMBQC in water.



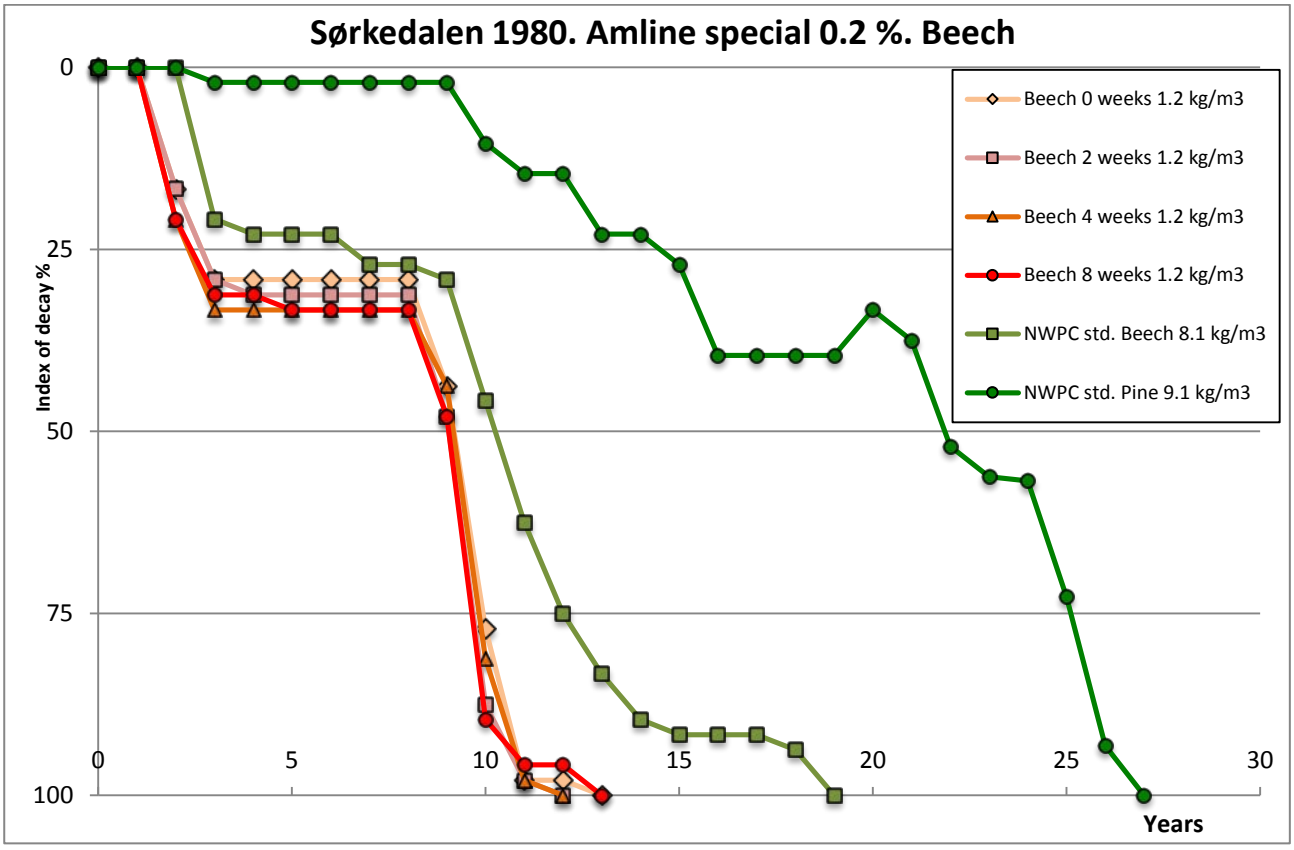
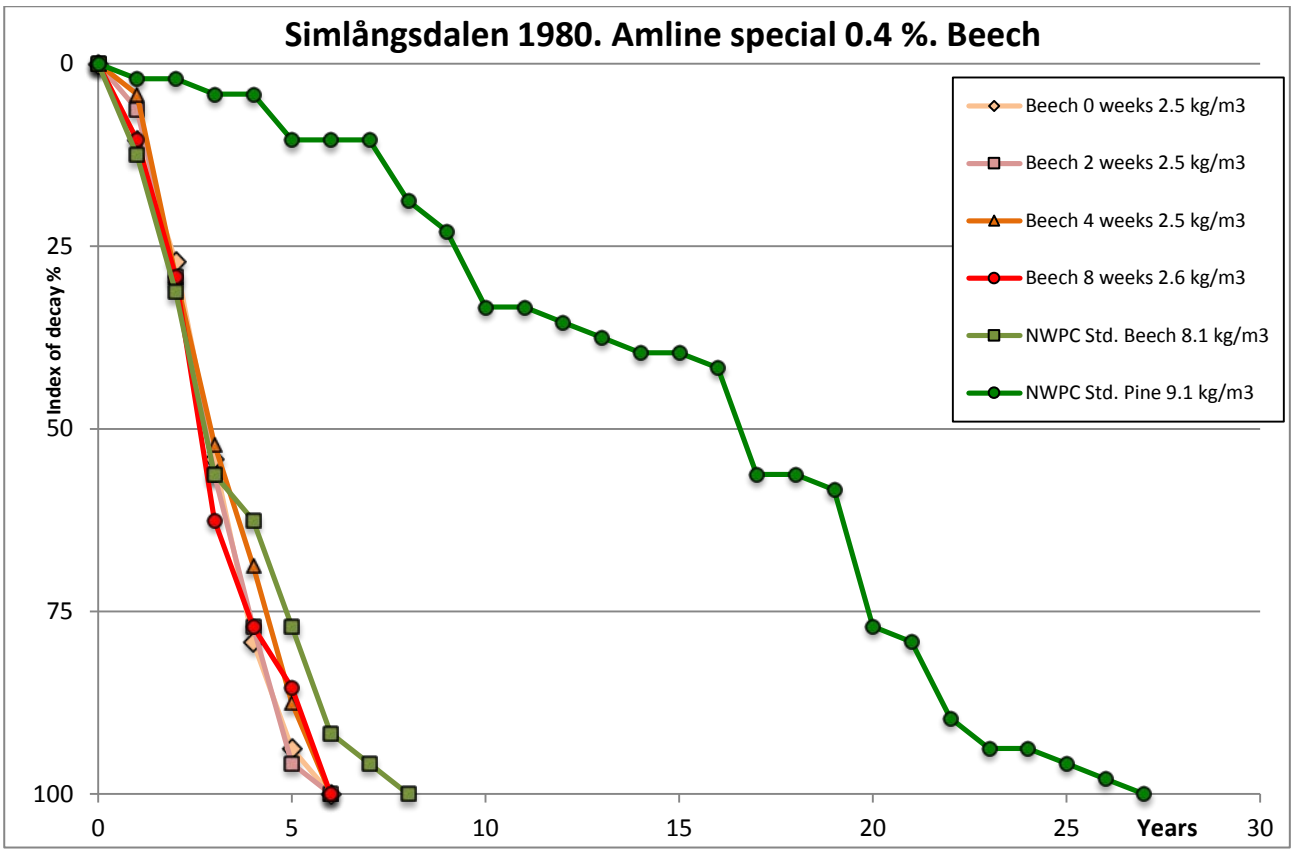


Figure 66. Field trial 1980:2. Index of decay for stakes of Beech treated with Amline special 0.2 %.



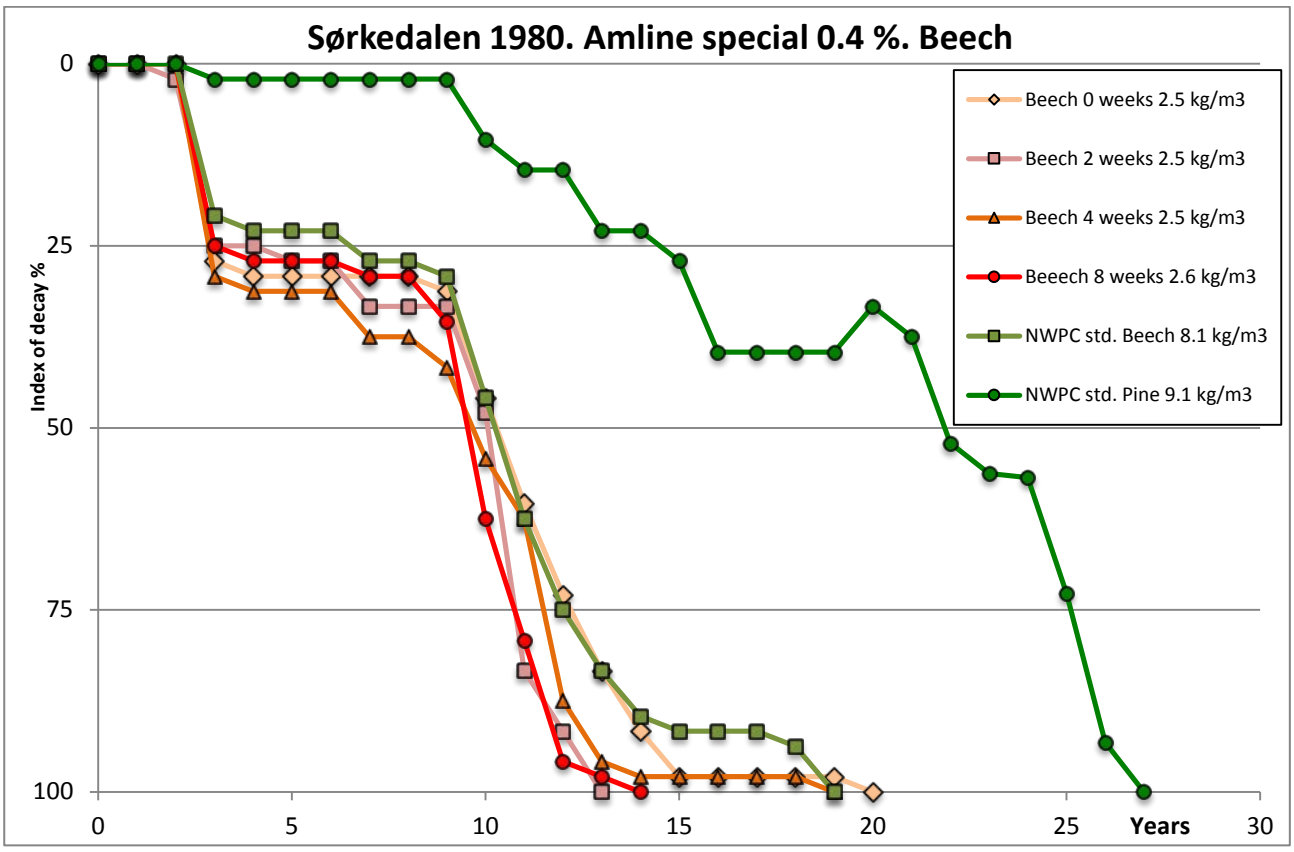
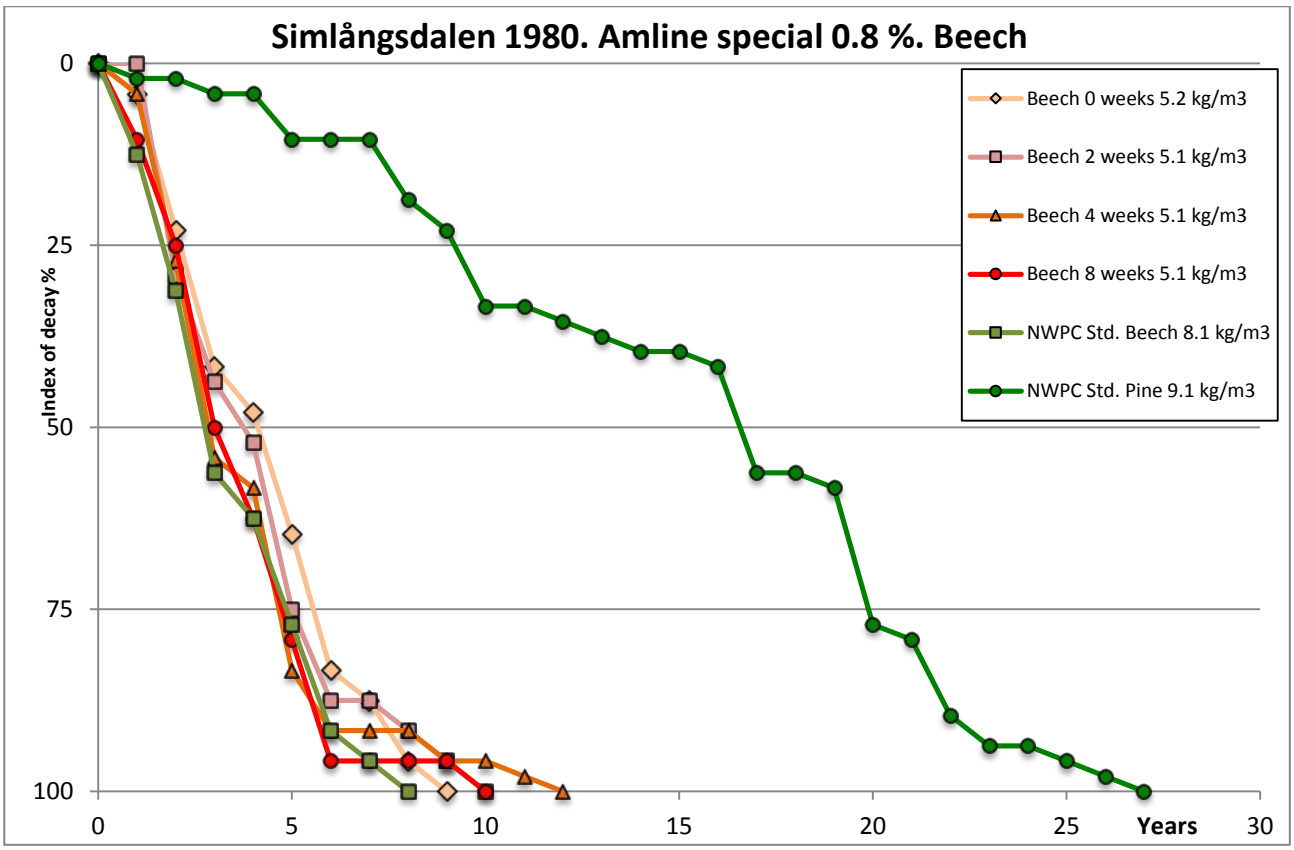


Figure 67. Field trial 1980:2. Index of decay for stakes of Beech treated with Amline special 0.4 %.



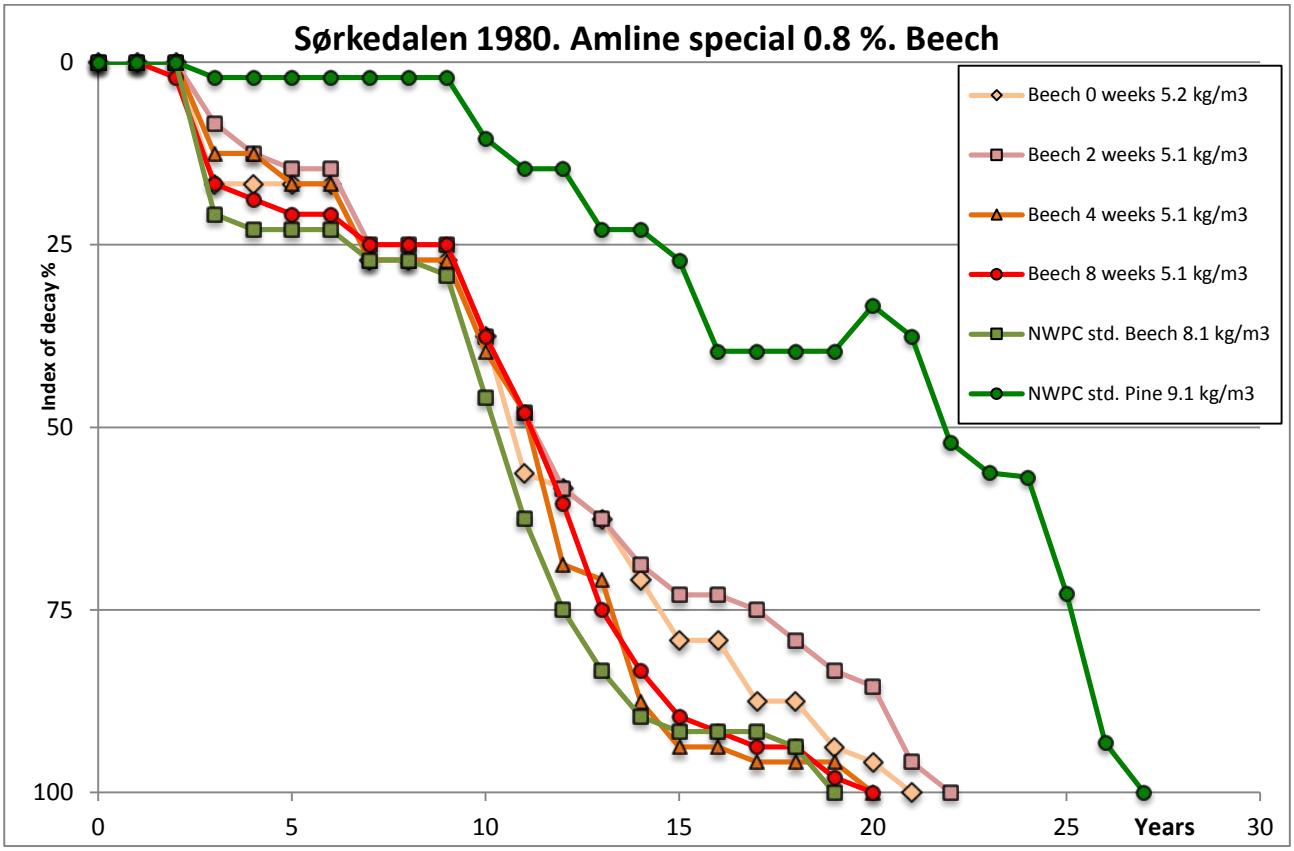
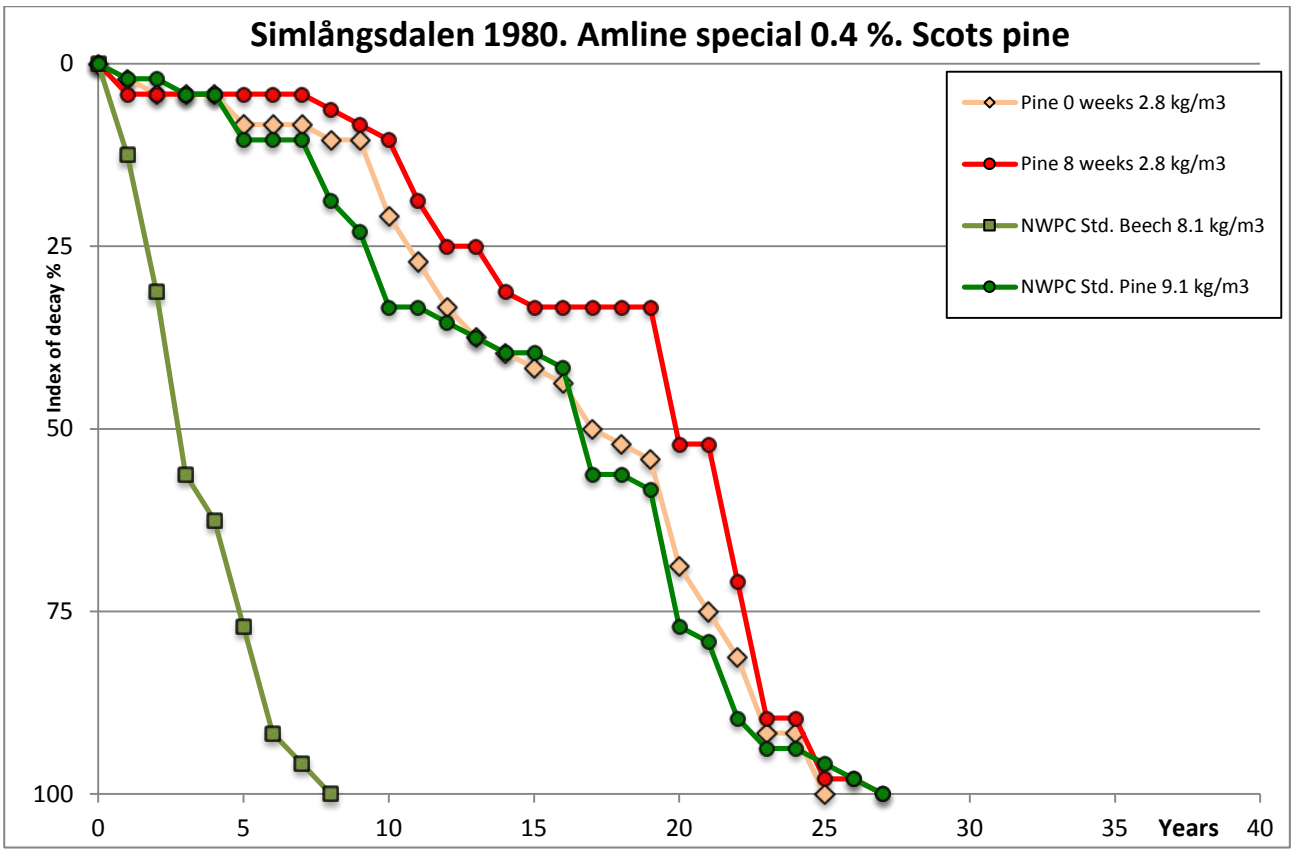


Figure 68. Field trial 1980:2. Index of decay for stakes of Beech treated with Amline special 0.8 %.



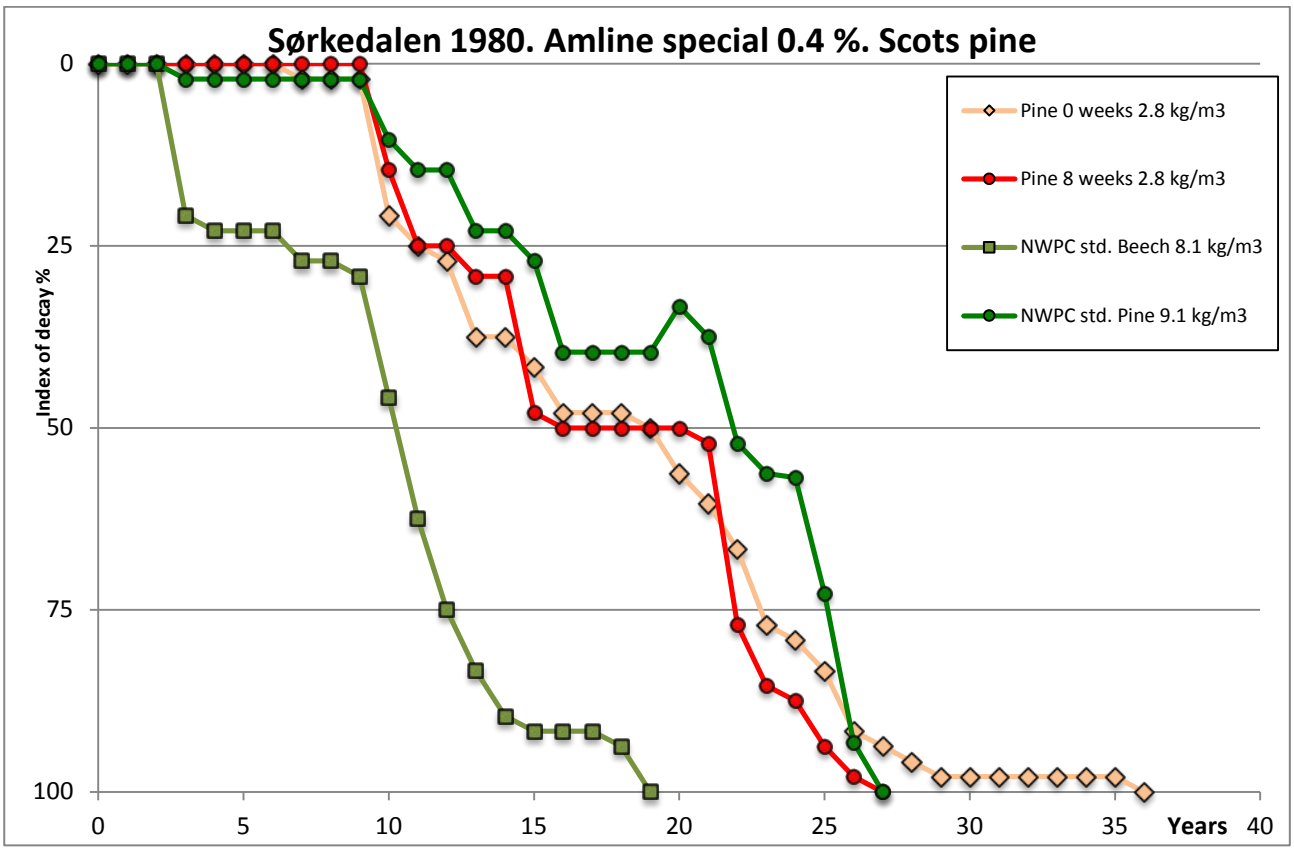
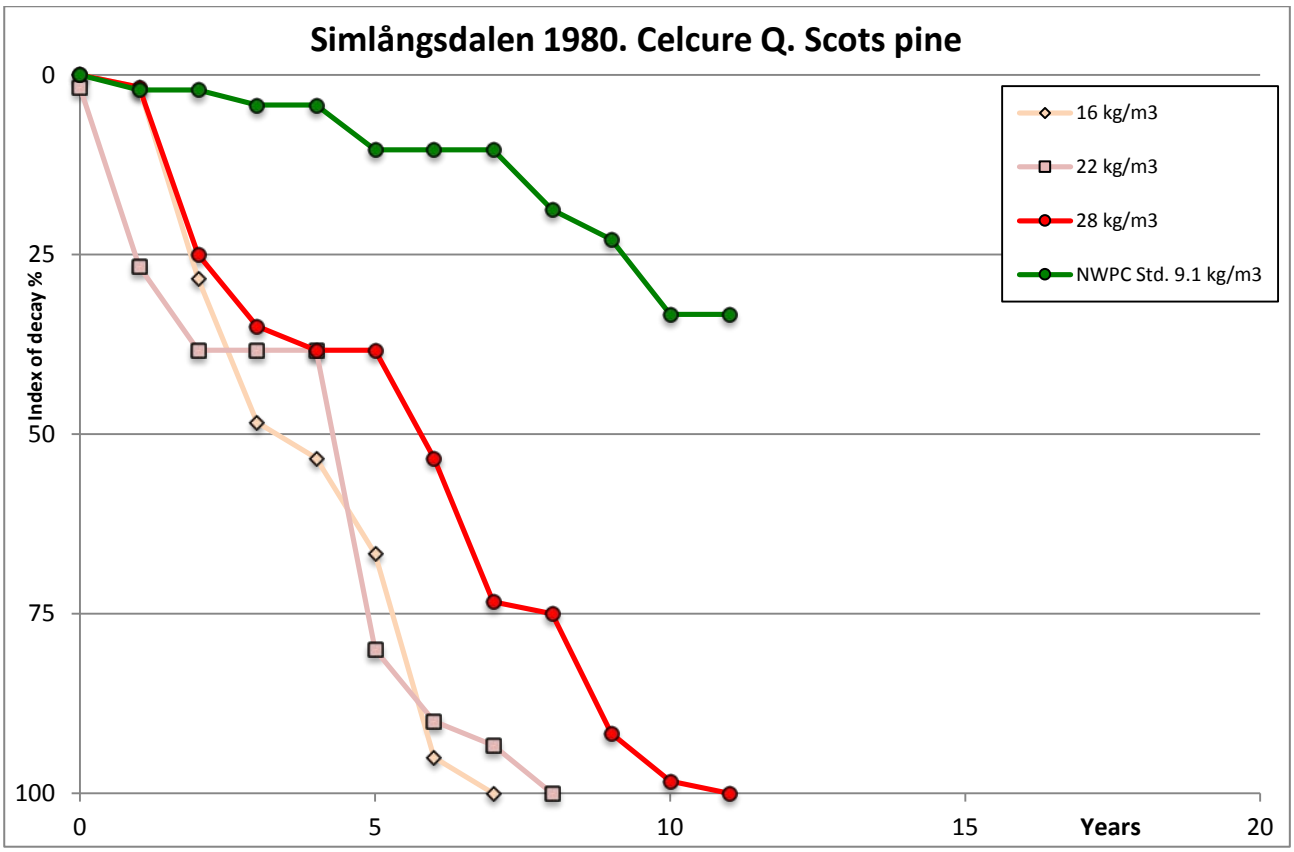


Figure 69. Field trial 1980:2. Index of decay for stakes of Scots pine treated with Amline special 0.4 %.



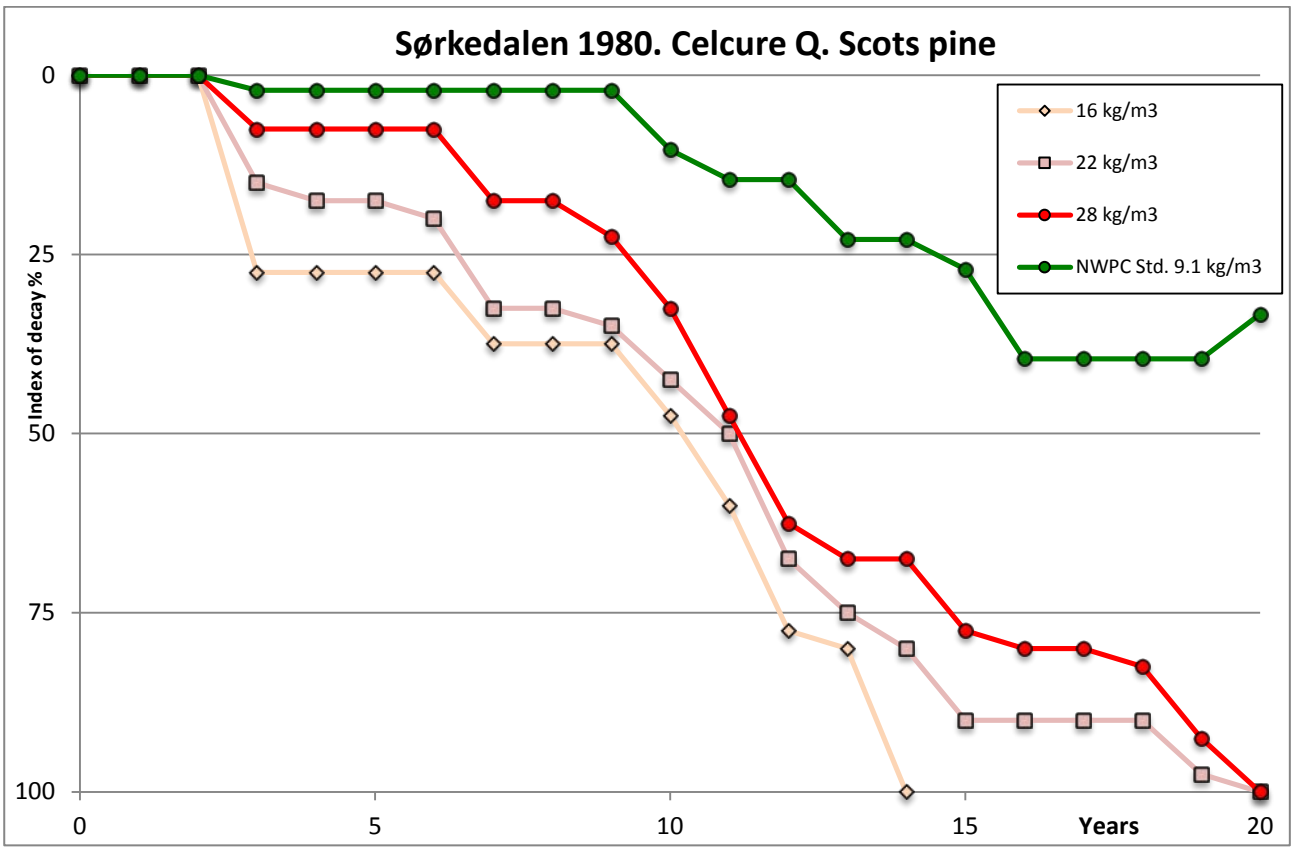
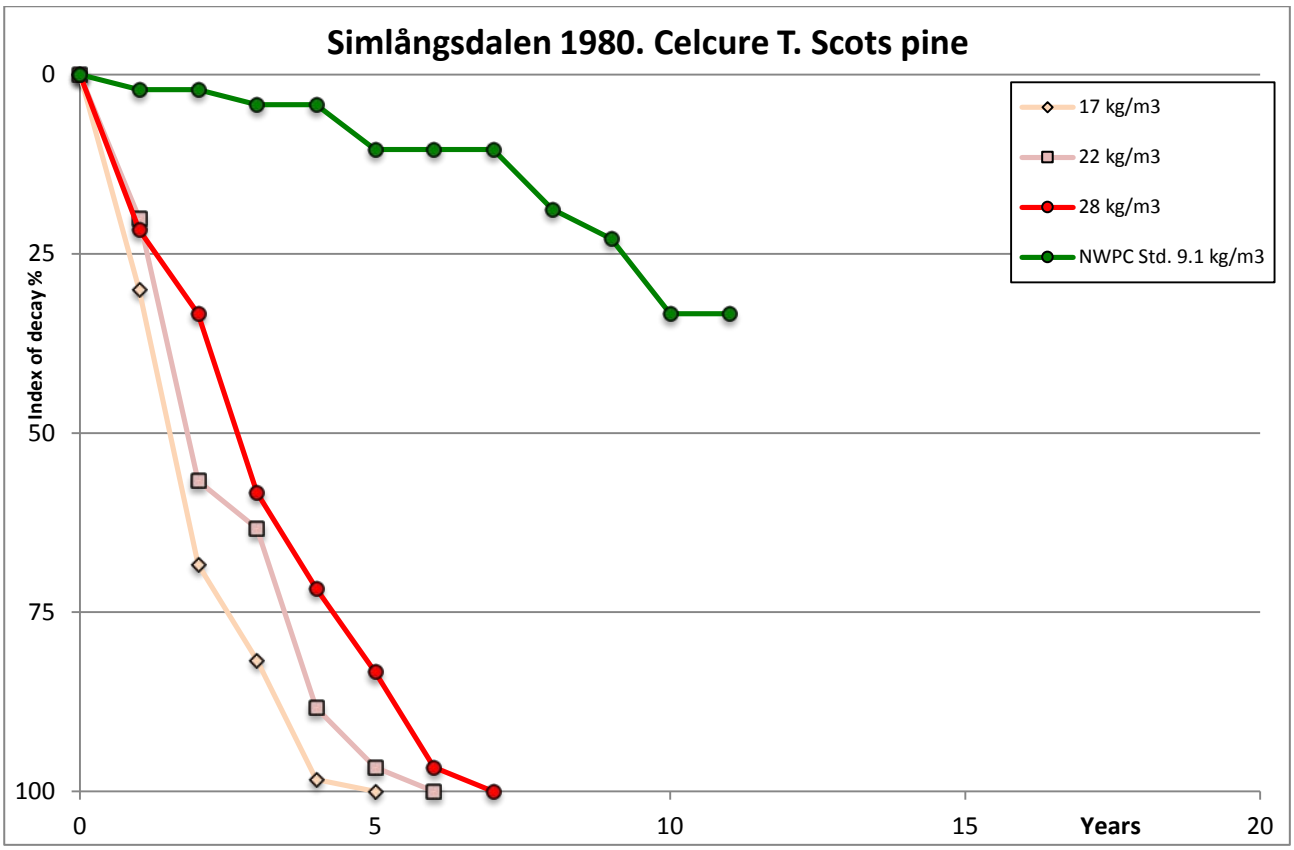


Figure 70. Field trial 1980:3. Index of decay for stakes of Scots pine treated with Celcure Q.



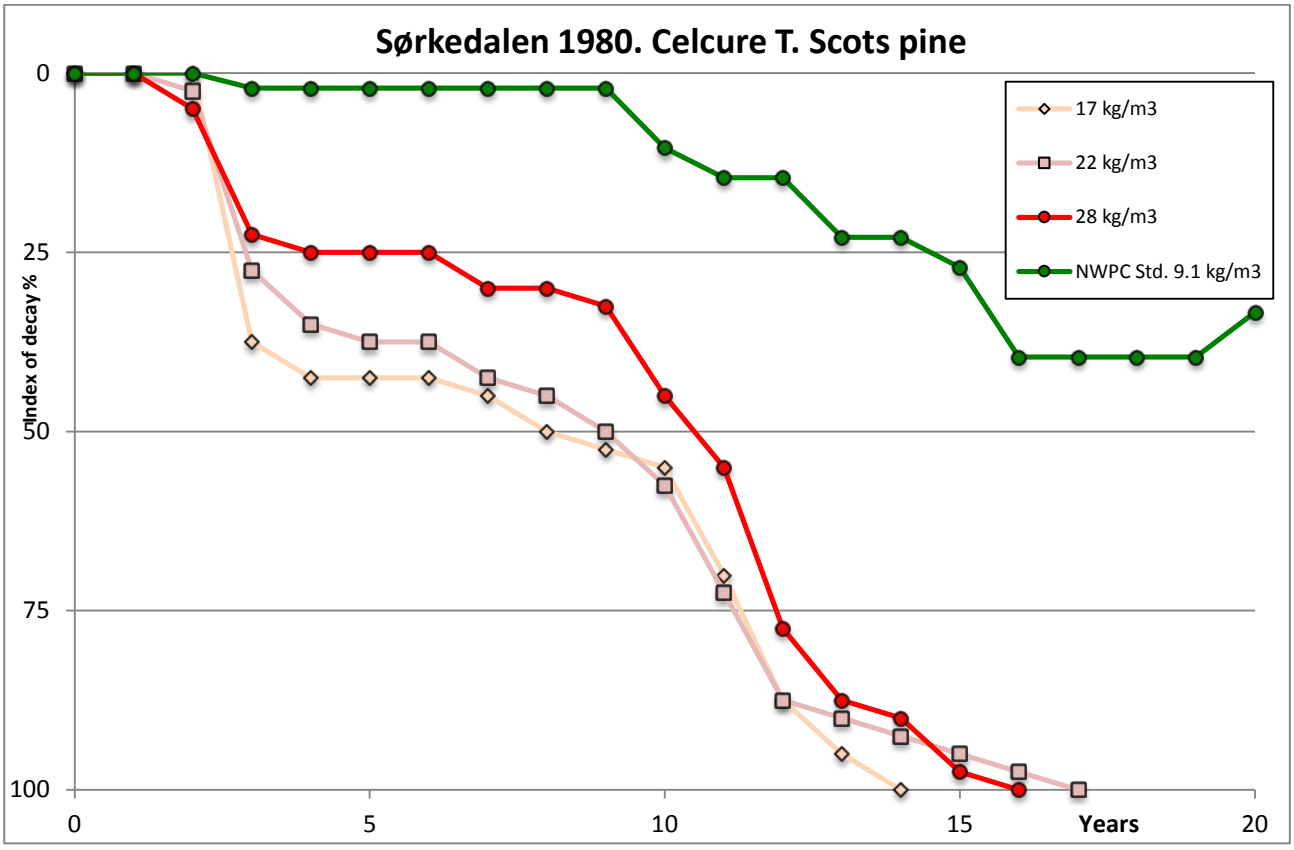
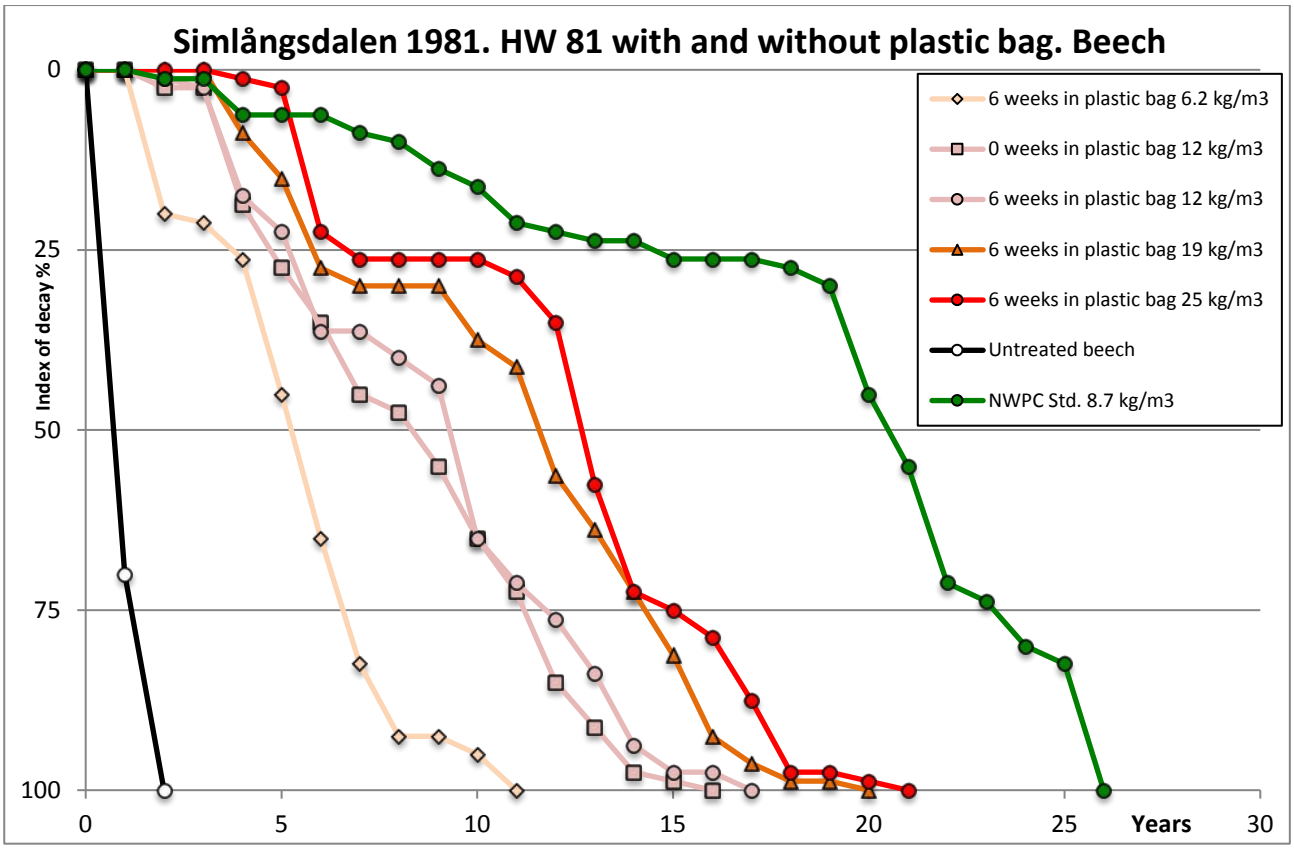


Figure 71. Field trial 1980:3. Index of decay for stakes of Scots pine treated with Celcure T.



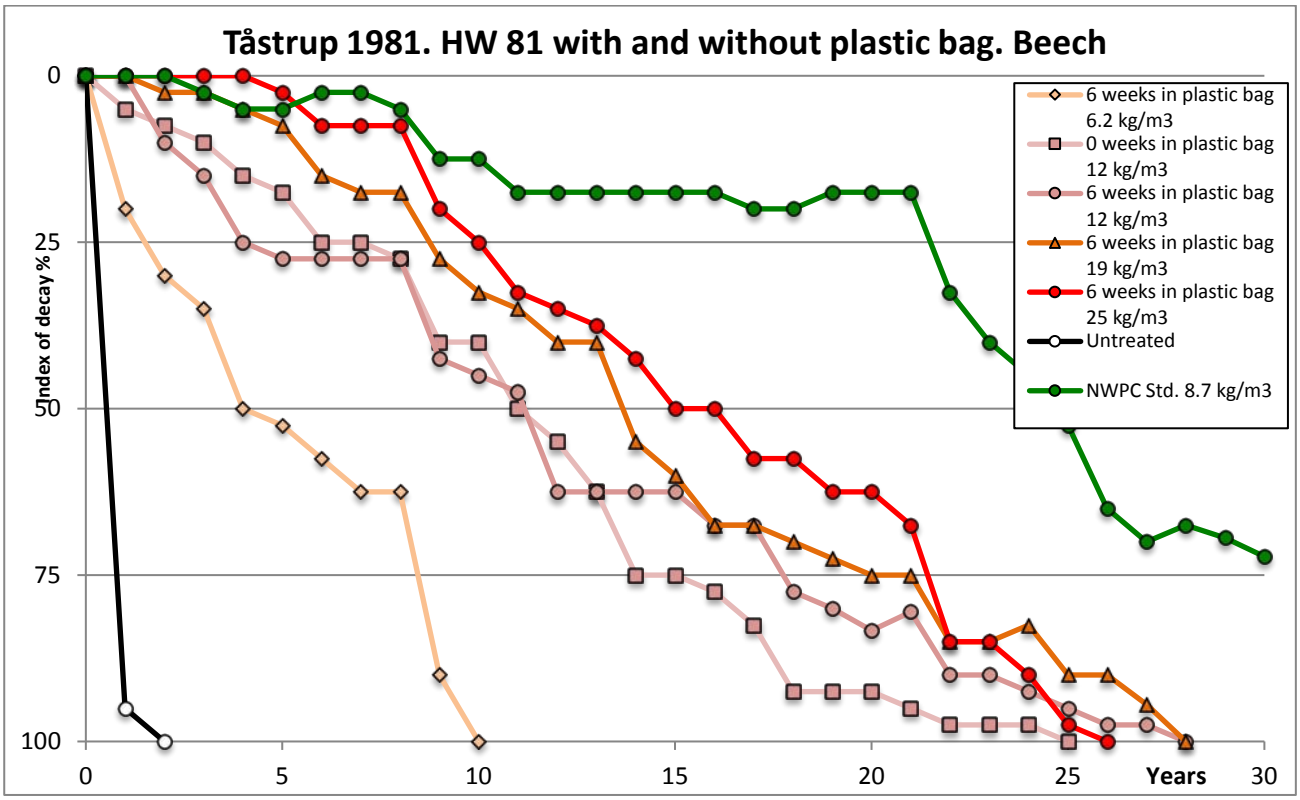
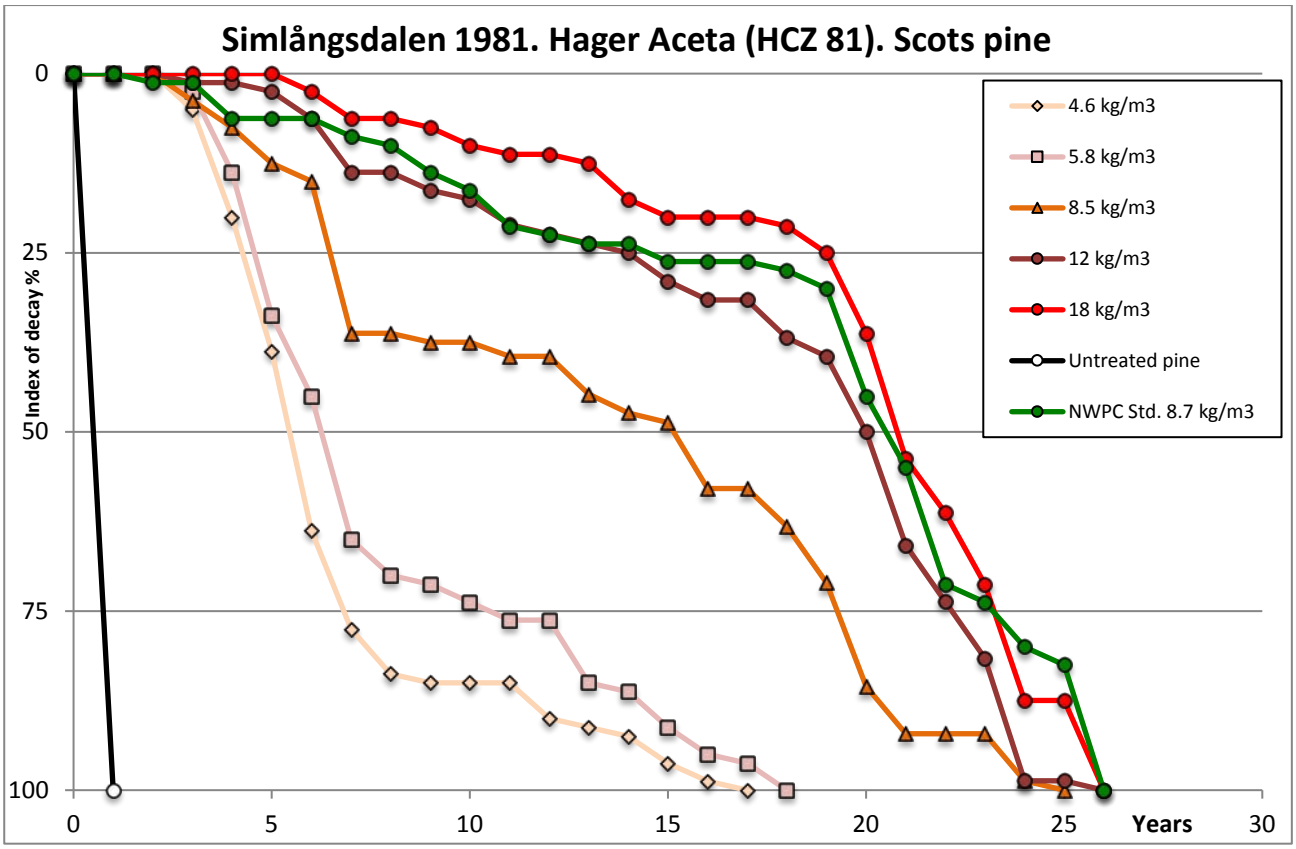


Figure 72. Field trial 1981. Index of decay for stakes of Beech treated with HW 81.



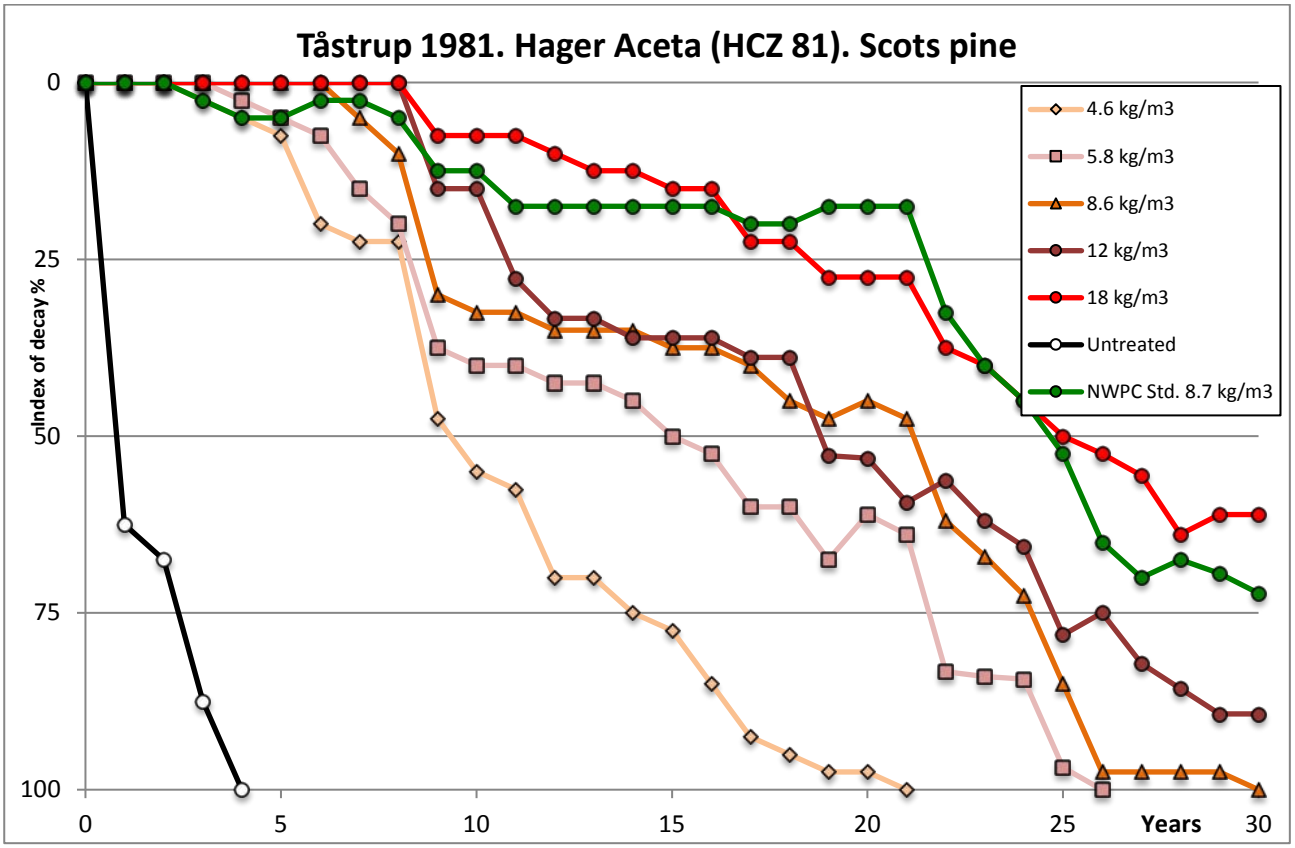
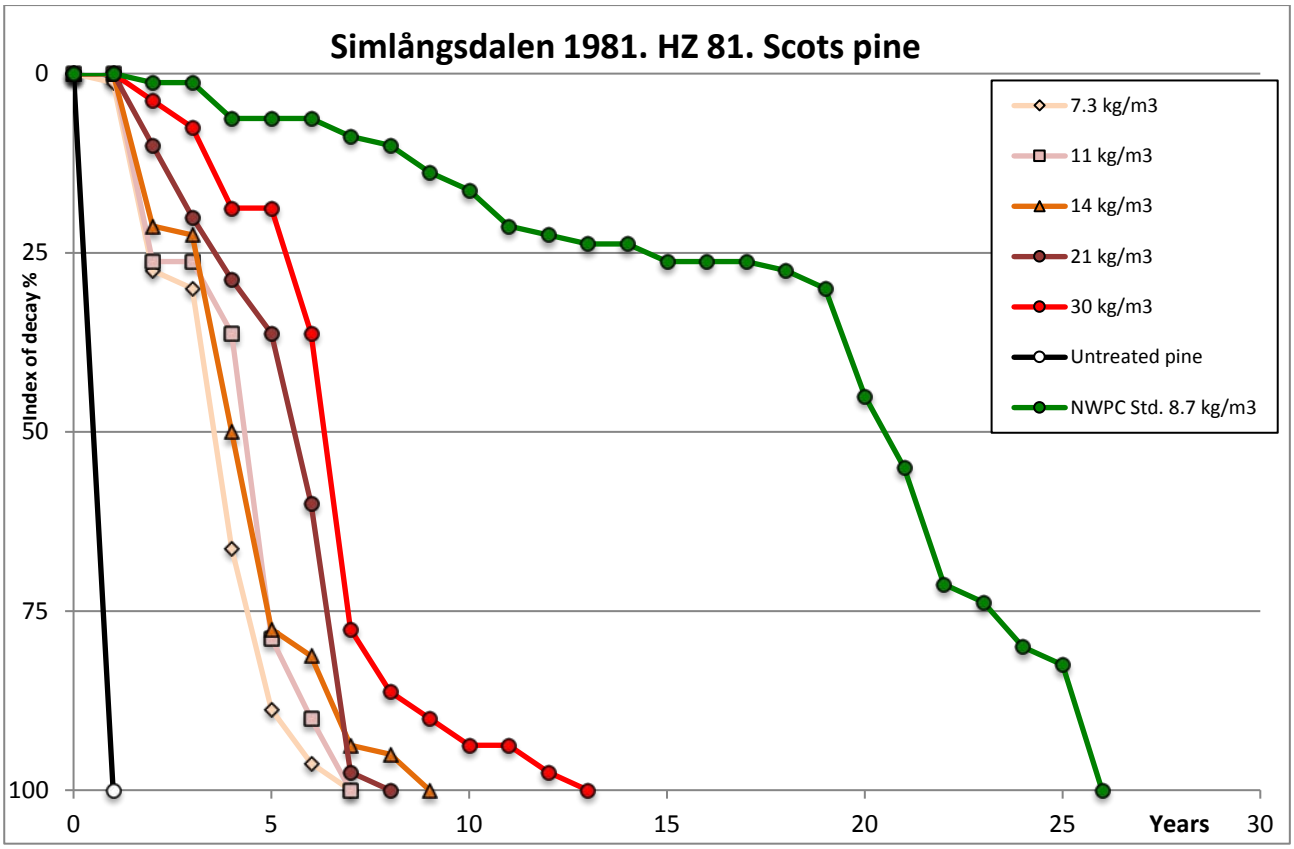


Figure 73. Field trial 1981. Index of decay for stakes of Scots pine treated with Hager Aceta (HCZ 81).



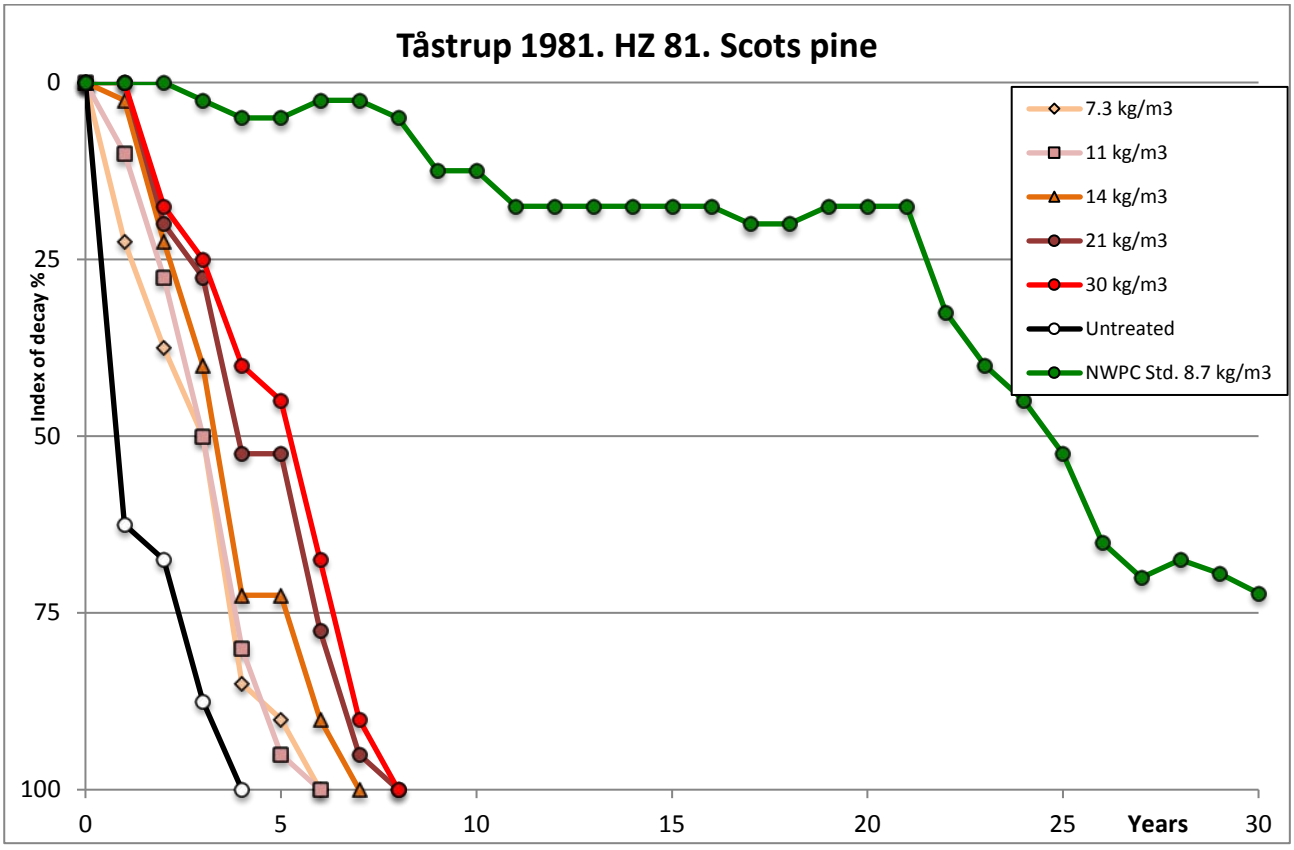
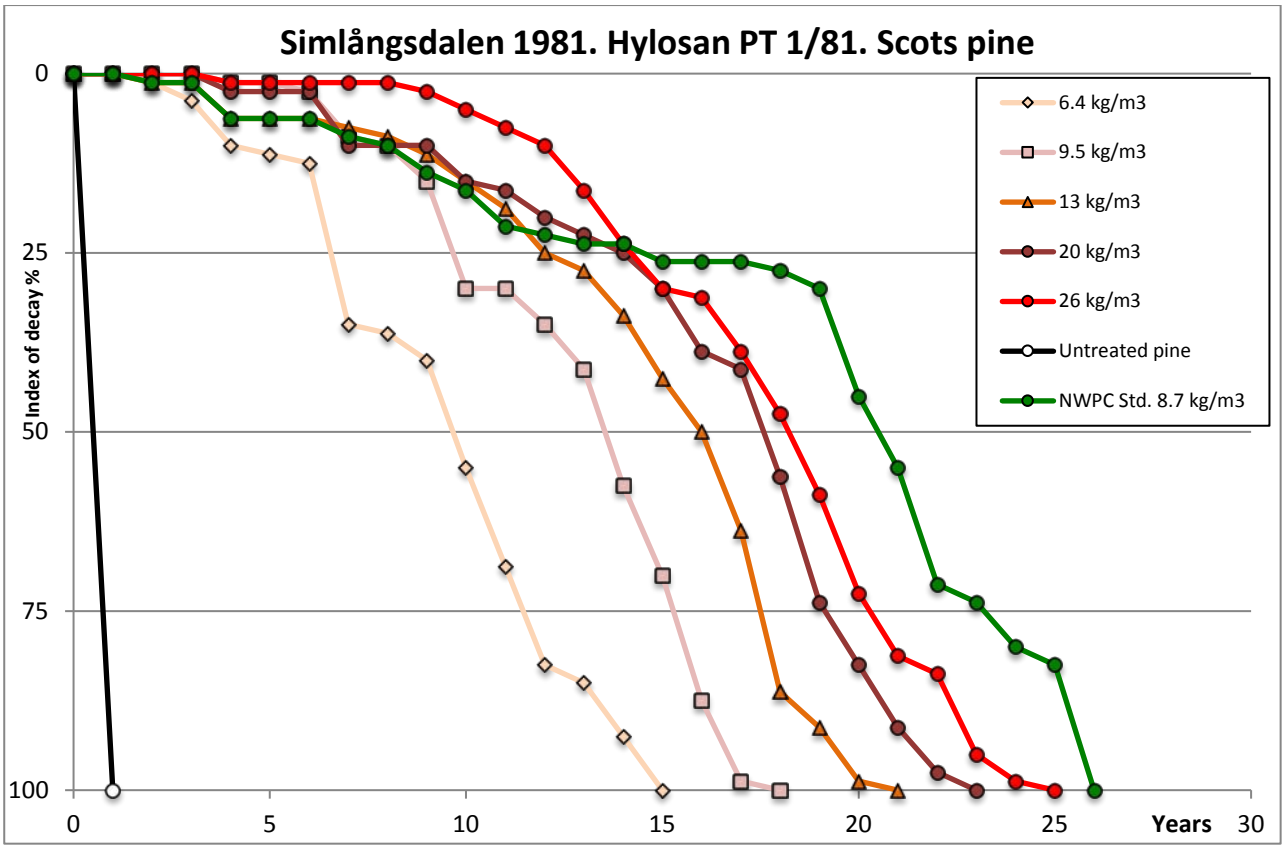


Figure 74. Field trial 1981. Index of decay for stakes of Scots pine treated with HW 81.



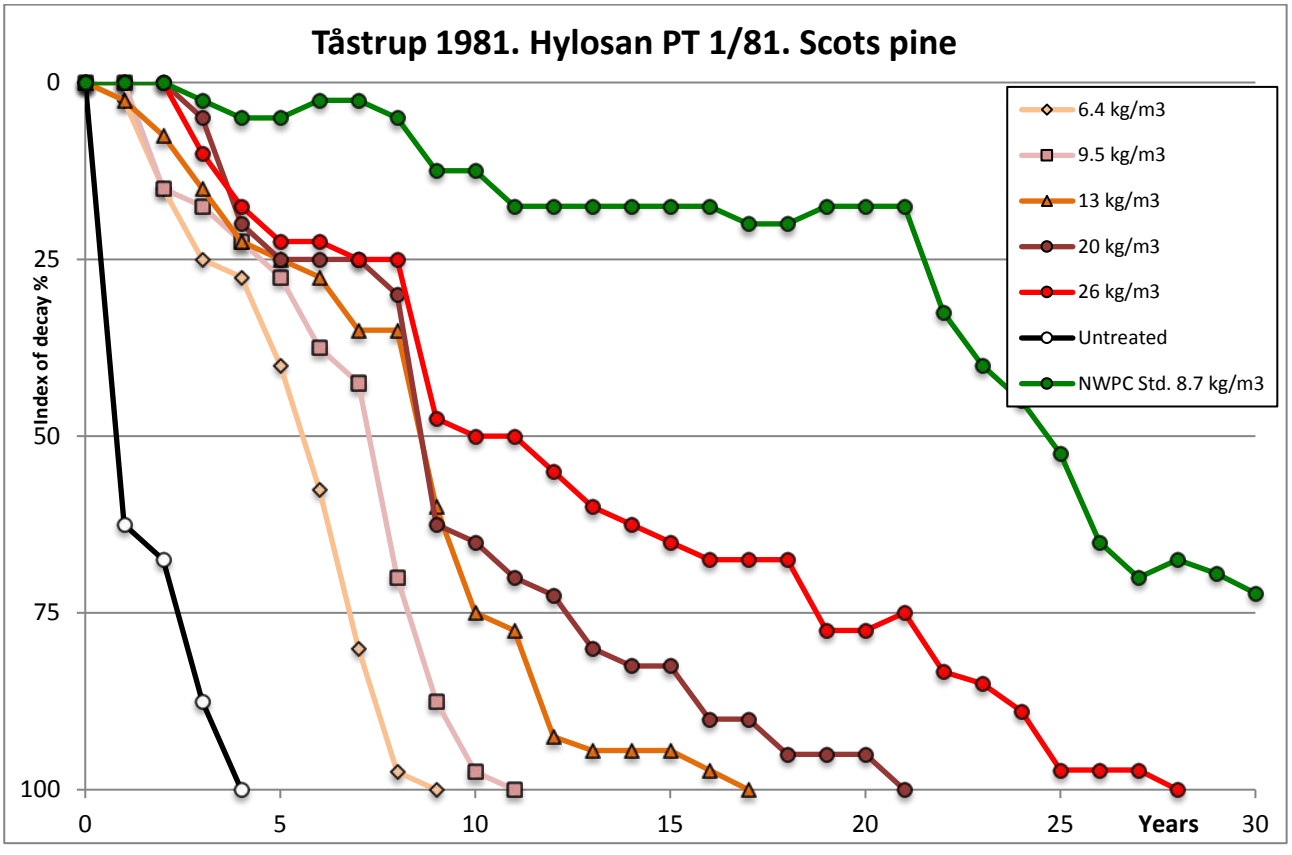
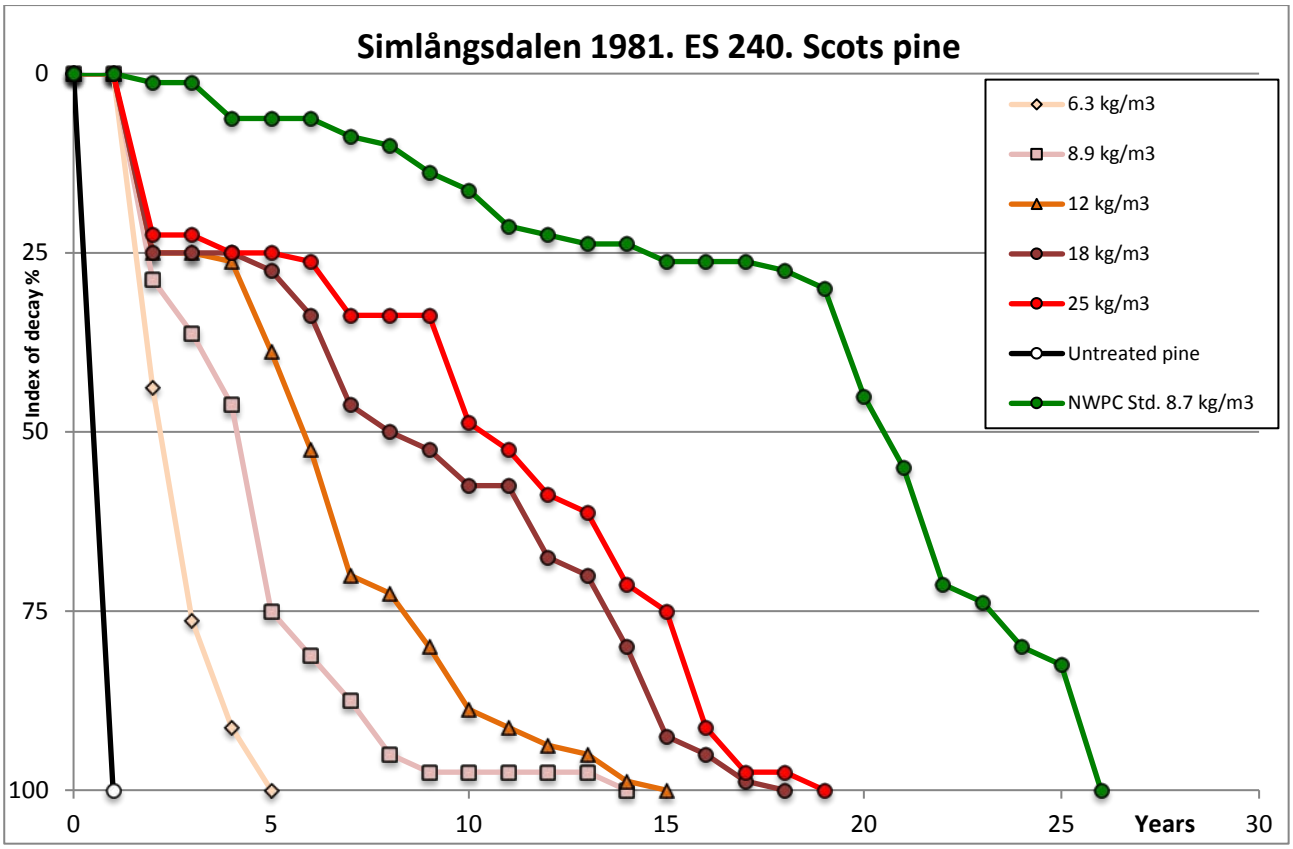


Figure 75. Field trial 1981. Index of decay for stakes of Scots pine treated with Hylosan PT 1/81.



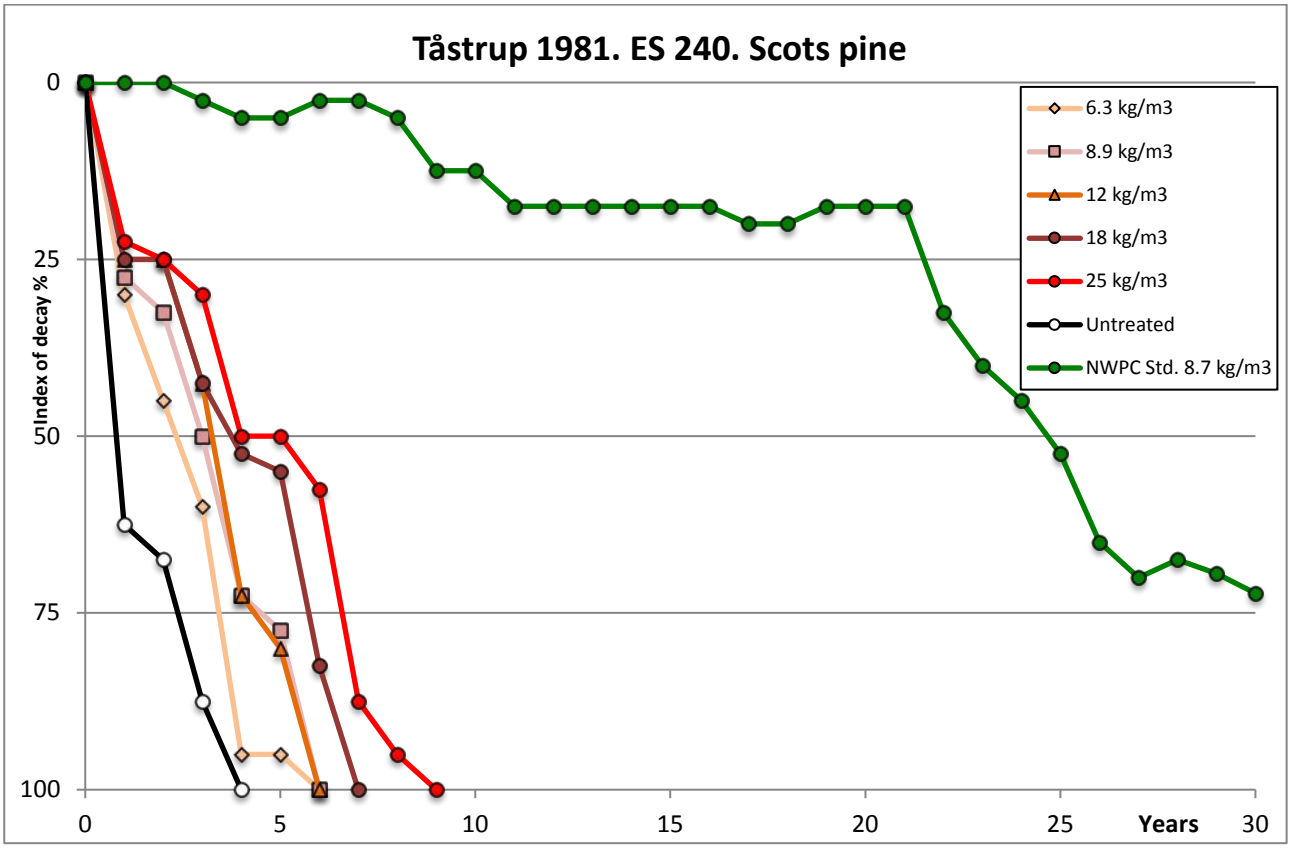
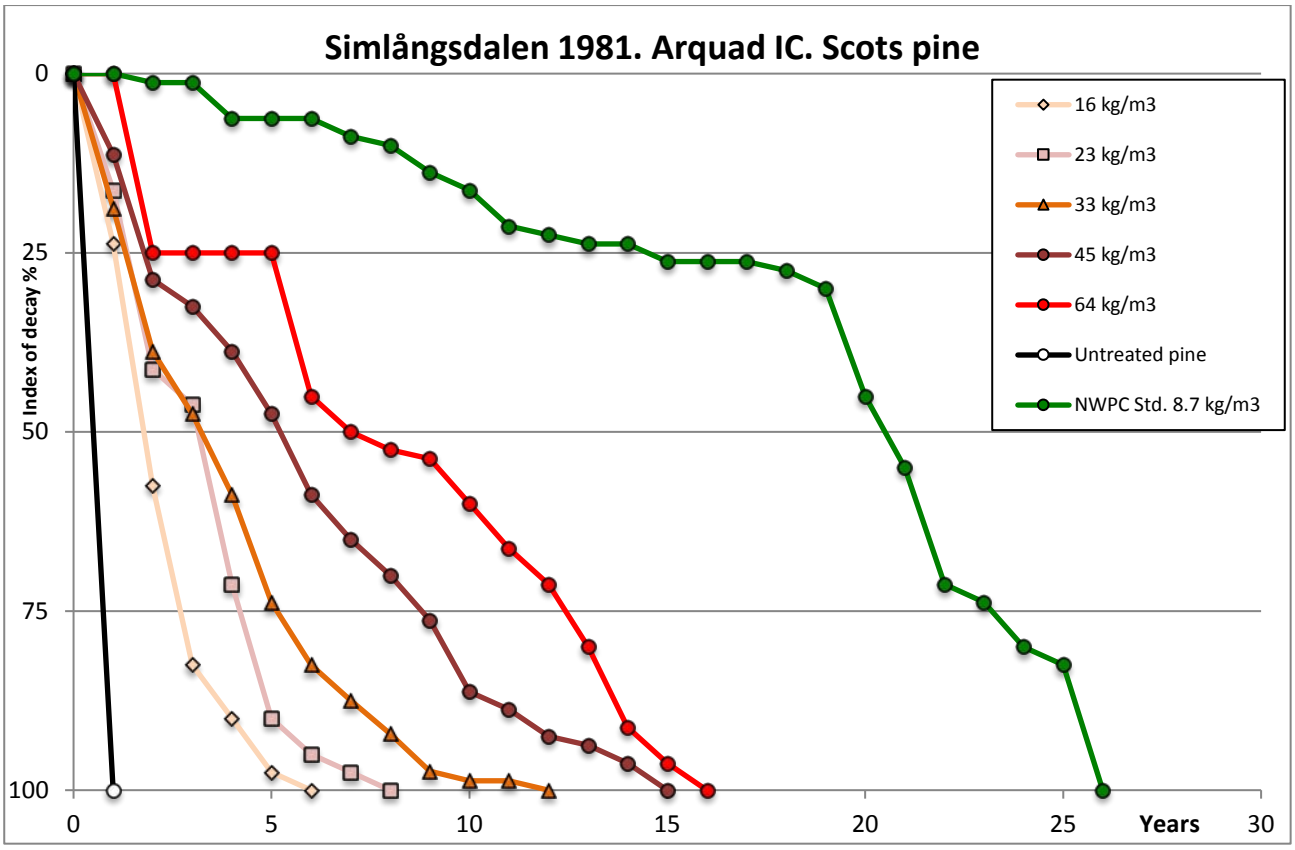


Figure 76. Field trial 1981. Index of decay for stakes of Scots pine treated with ES 240.



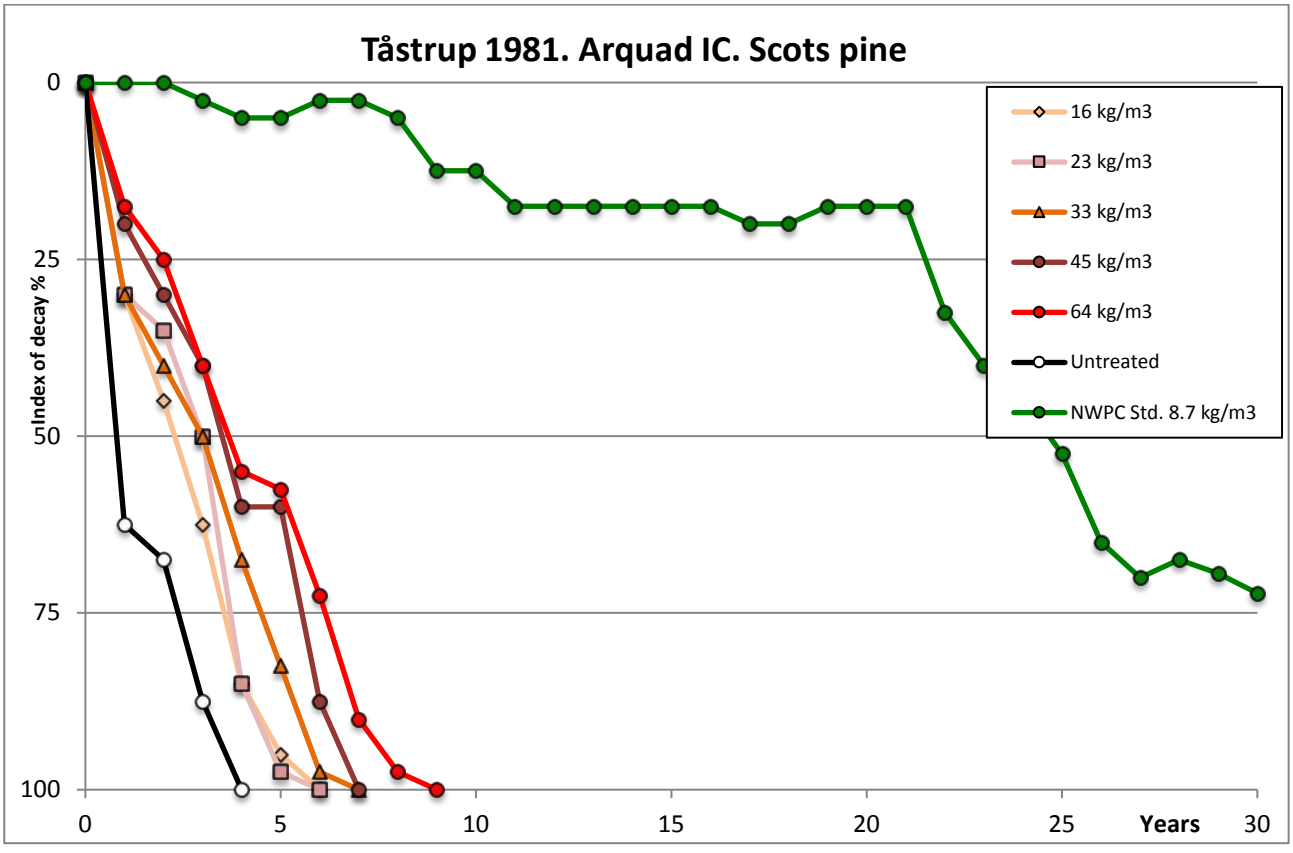
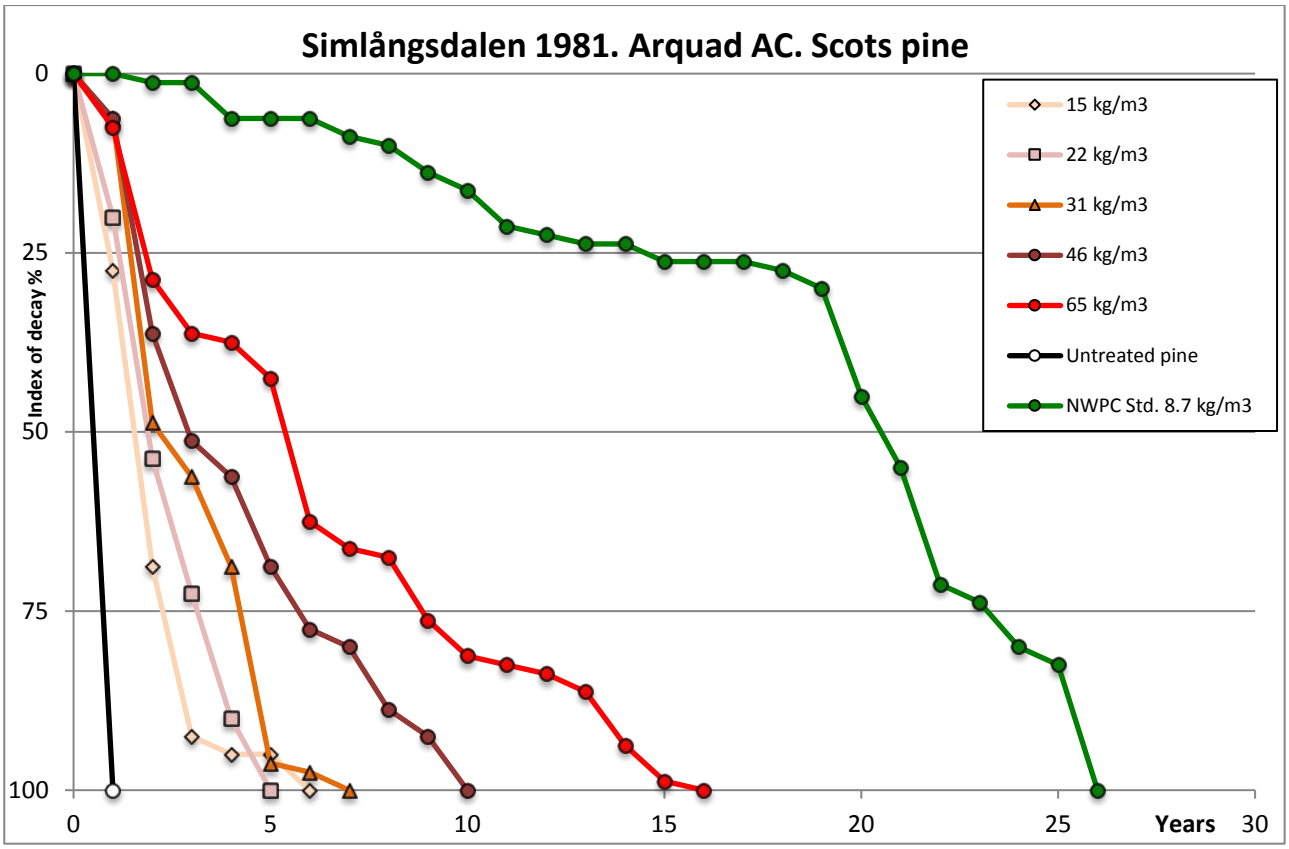


Figure 77. Field trial 1981. Index of decay for stakes of Scots pine treated with Arquad IC.



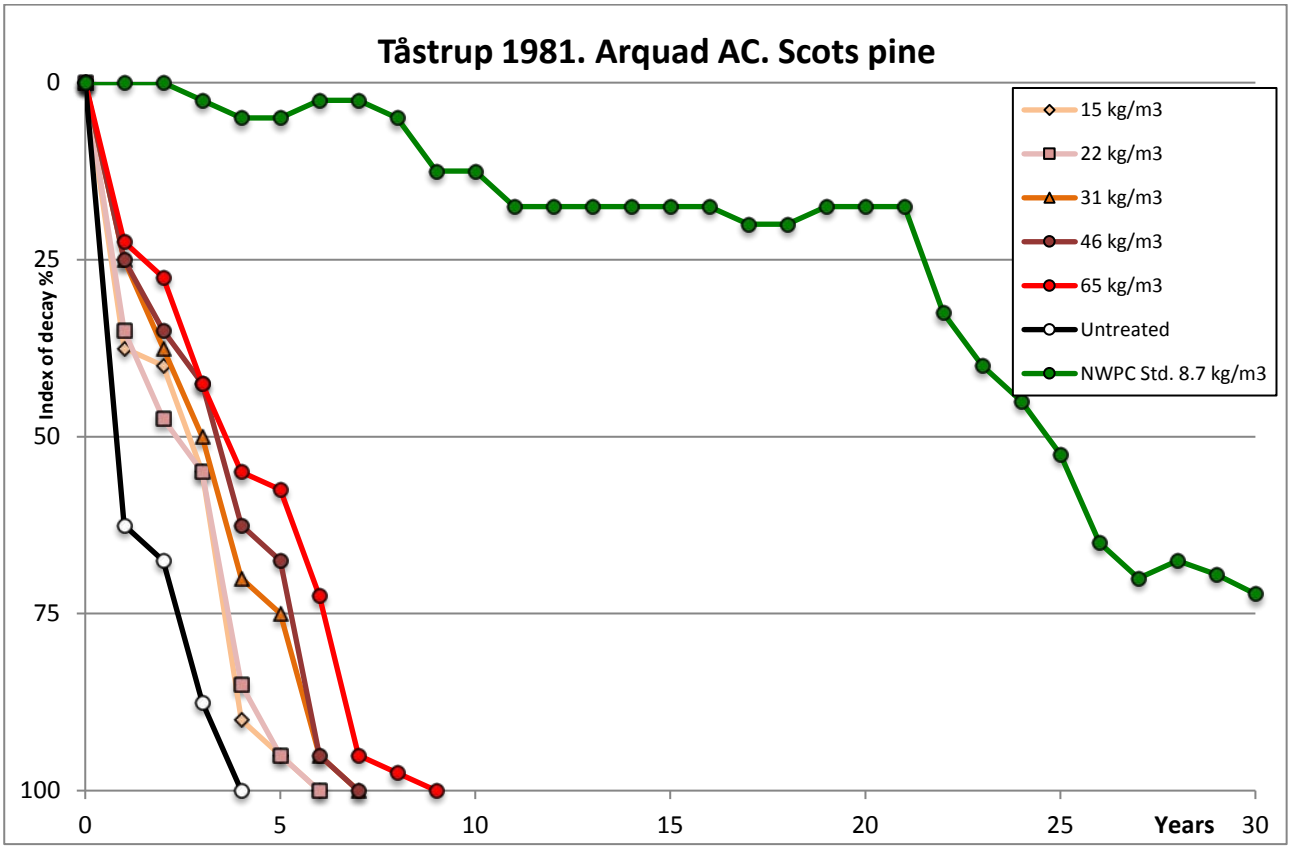
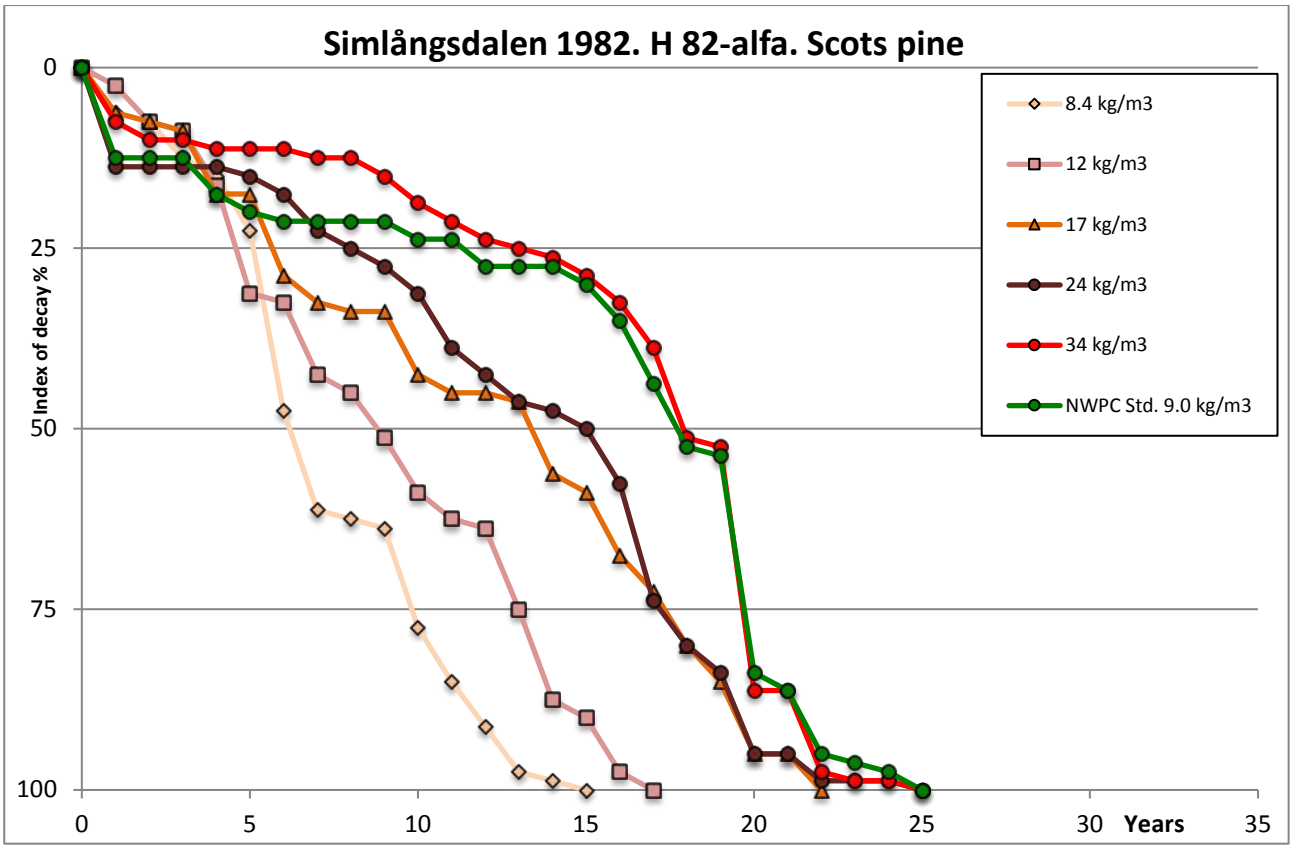


Figure 78. Field trial 1981. Index of decay for stakes of Scots pine treated with Arquad AC.



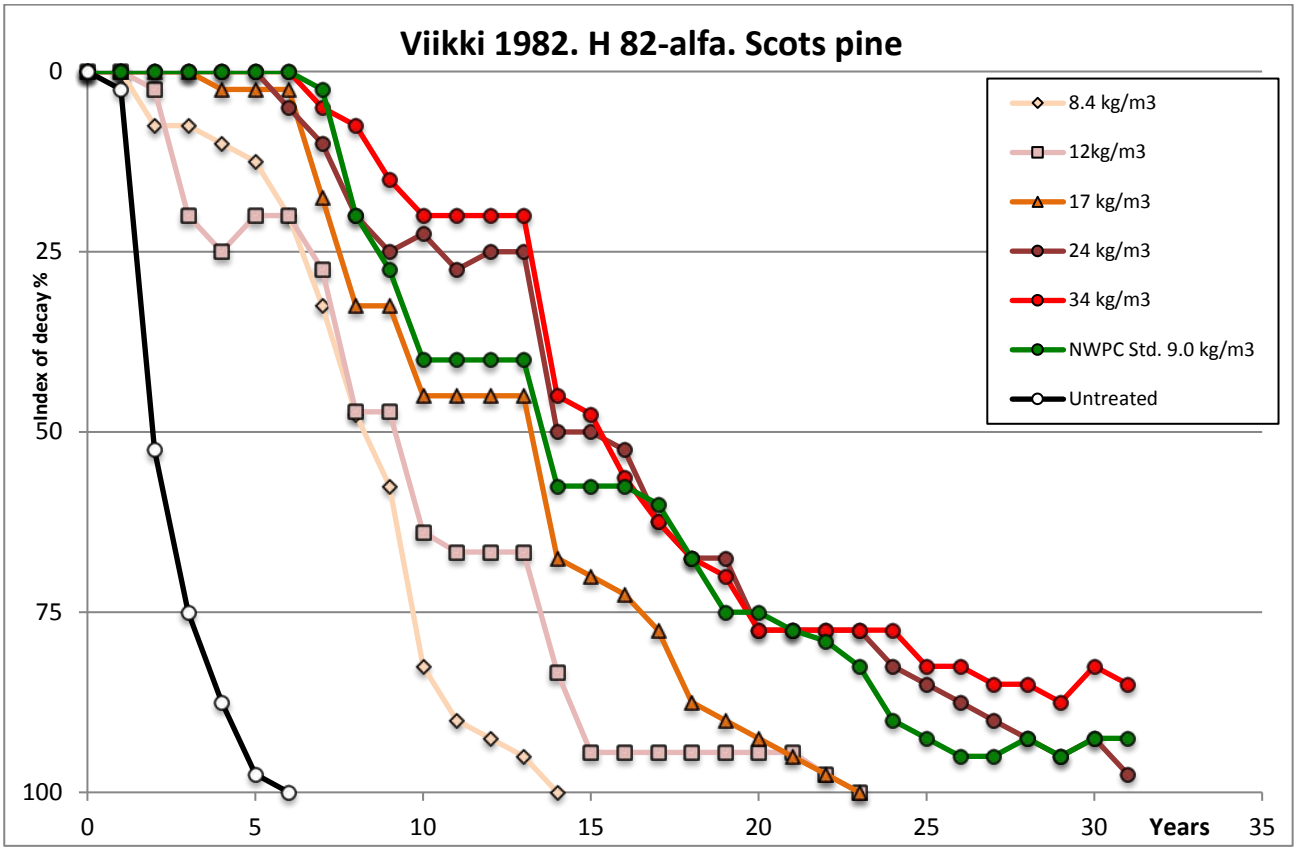
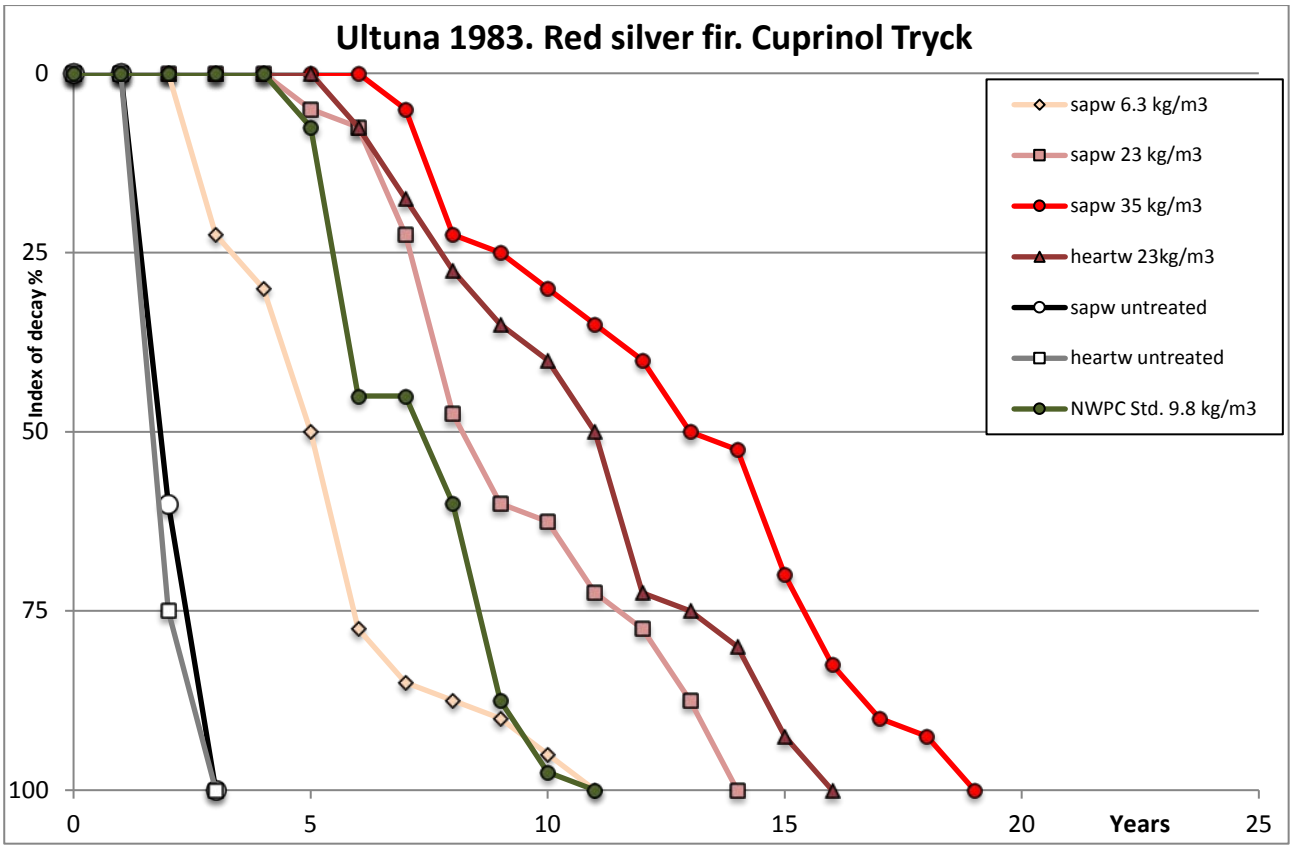


Figure 79. Field trial 1982. Index of decay for stakes of Scots pine treated H 82-alfa.



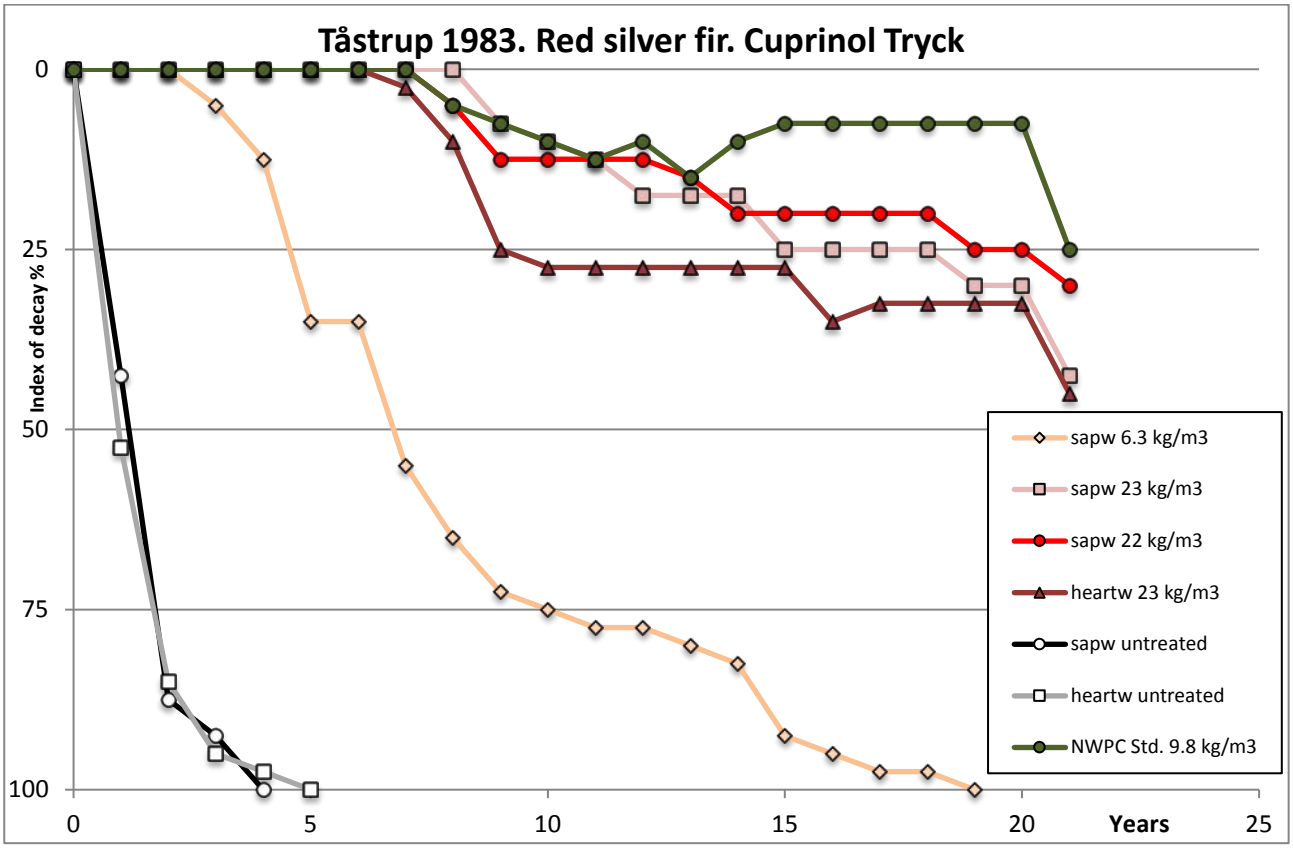
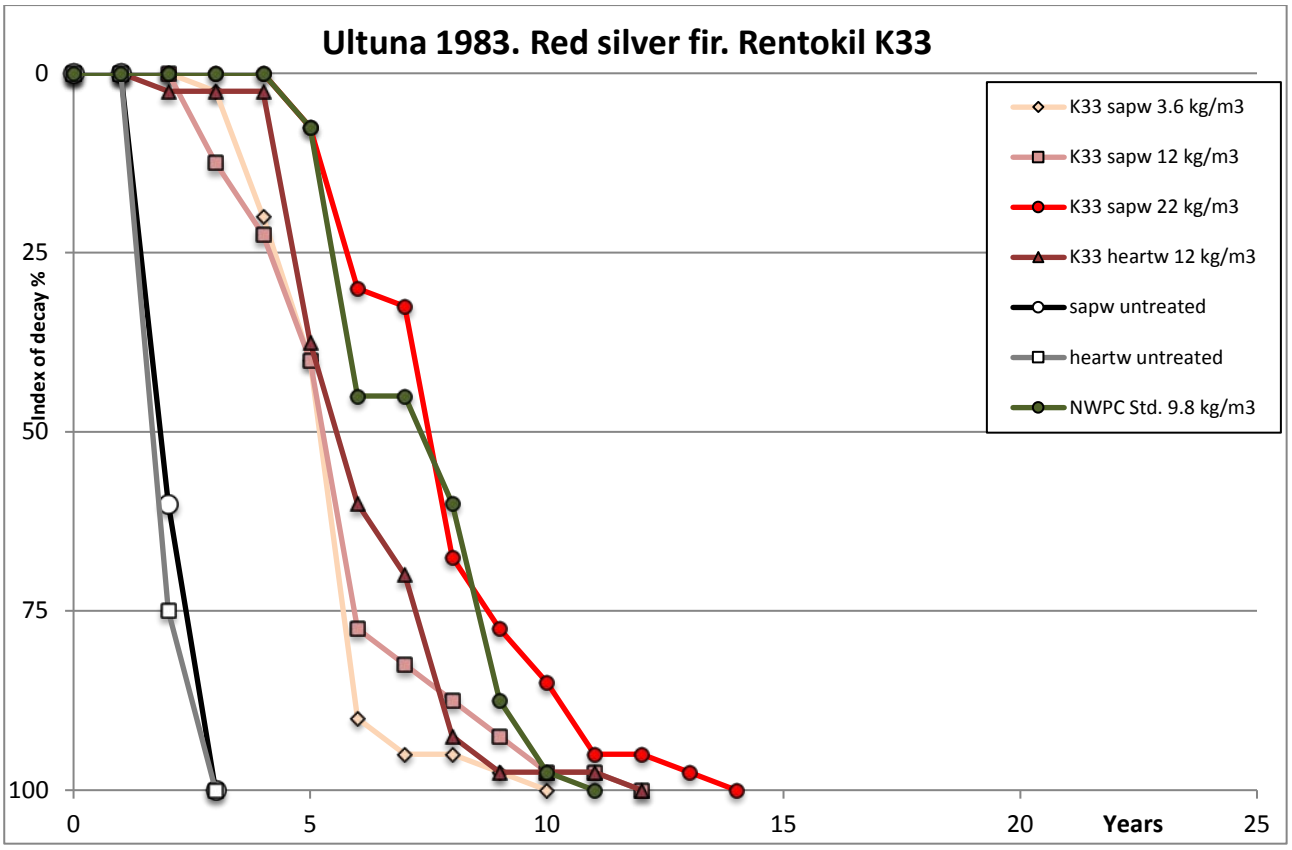


Figure 80. Field trial 1982-83. Index of decay for stakes of Red silver fir treated with Cuprinol Tryck.



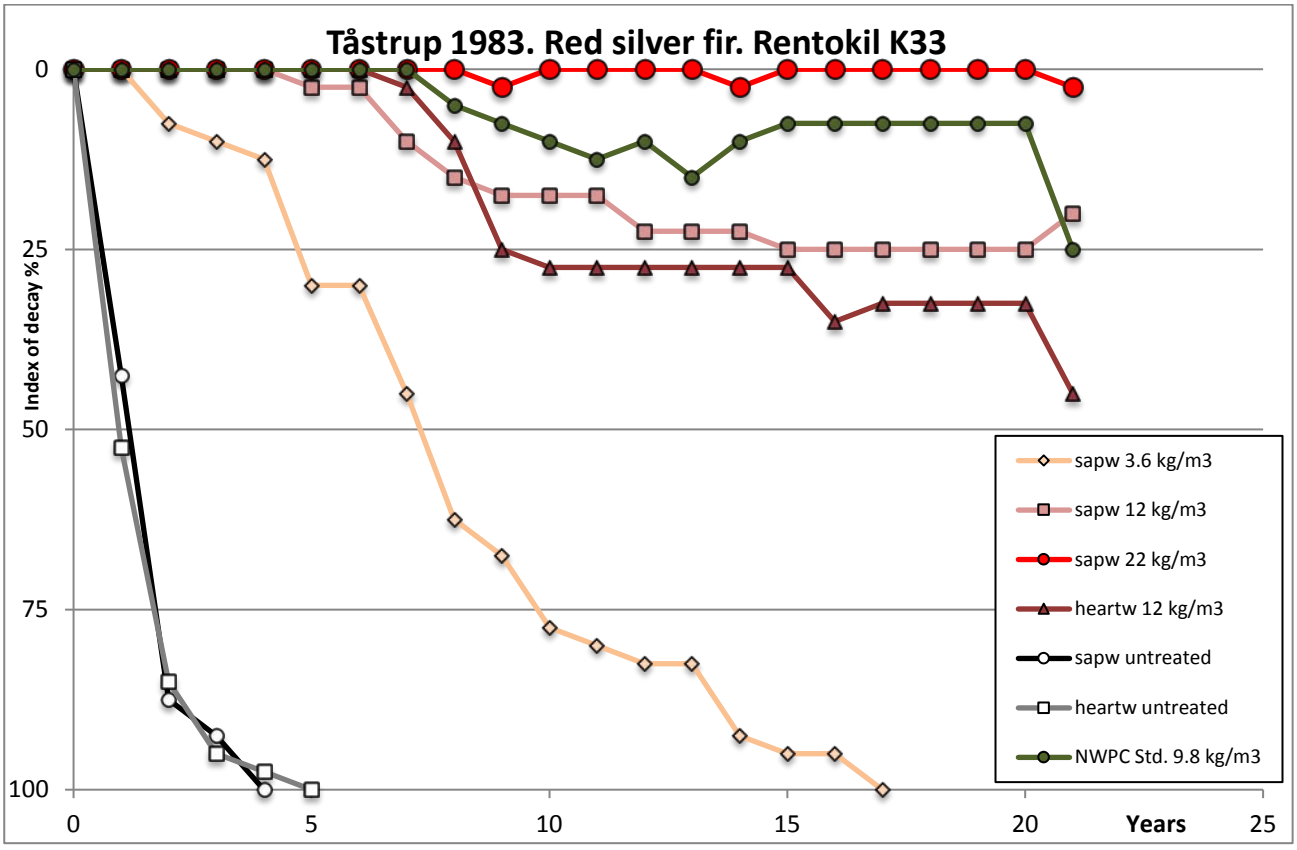
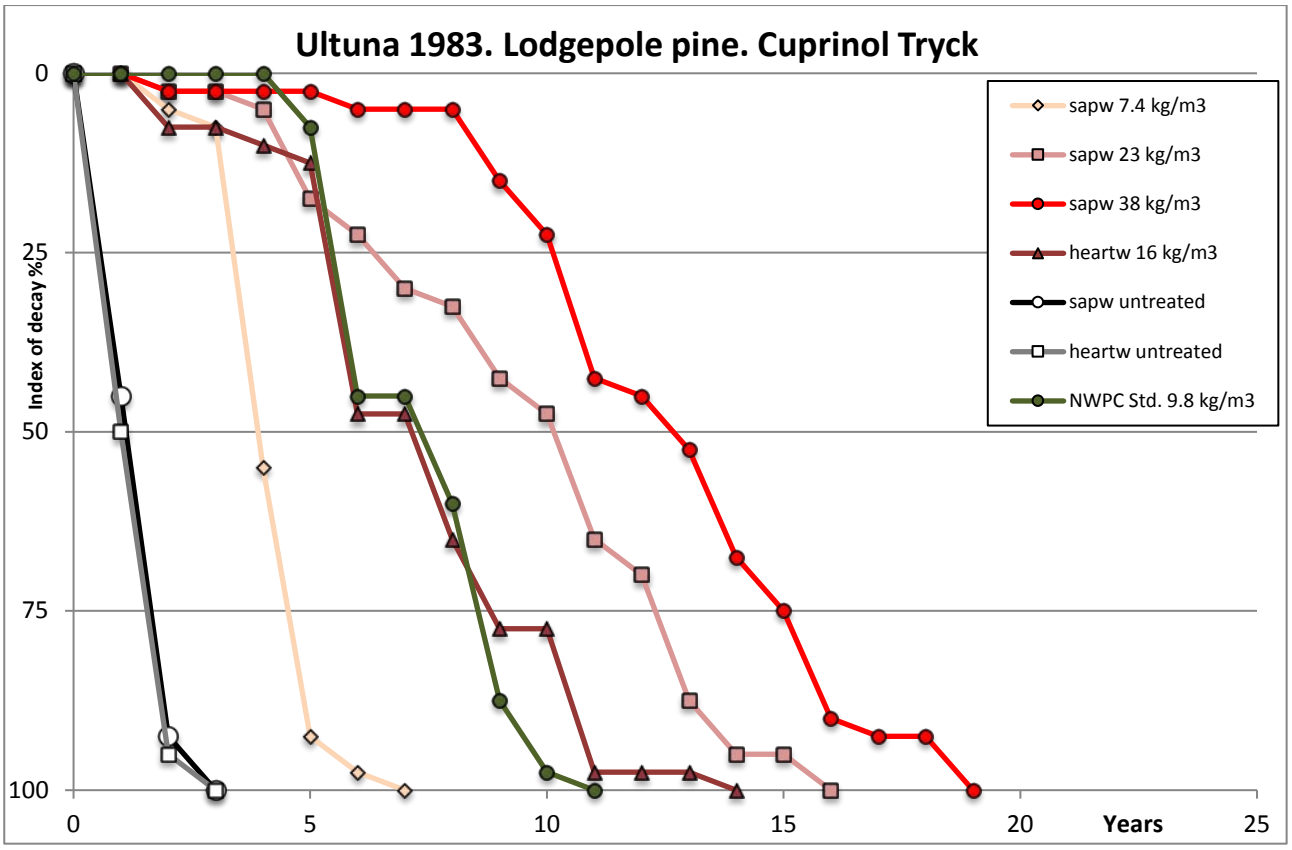


Figure 81. Field trial 1982-83. Index of decay for stakes of Red silver fir treated with Rentokil K33.



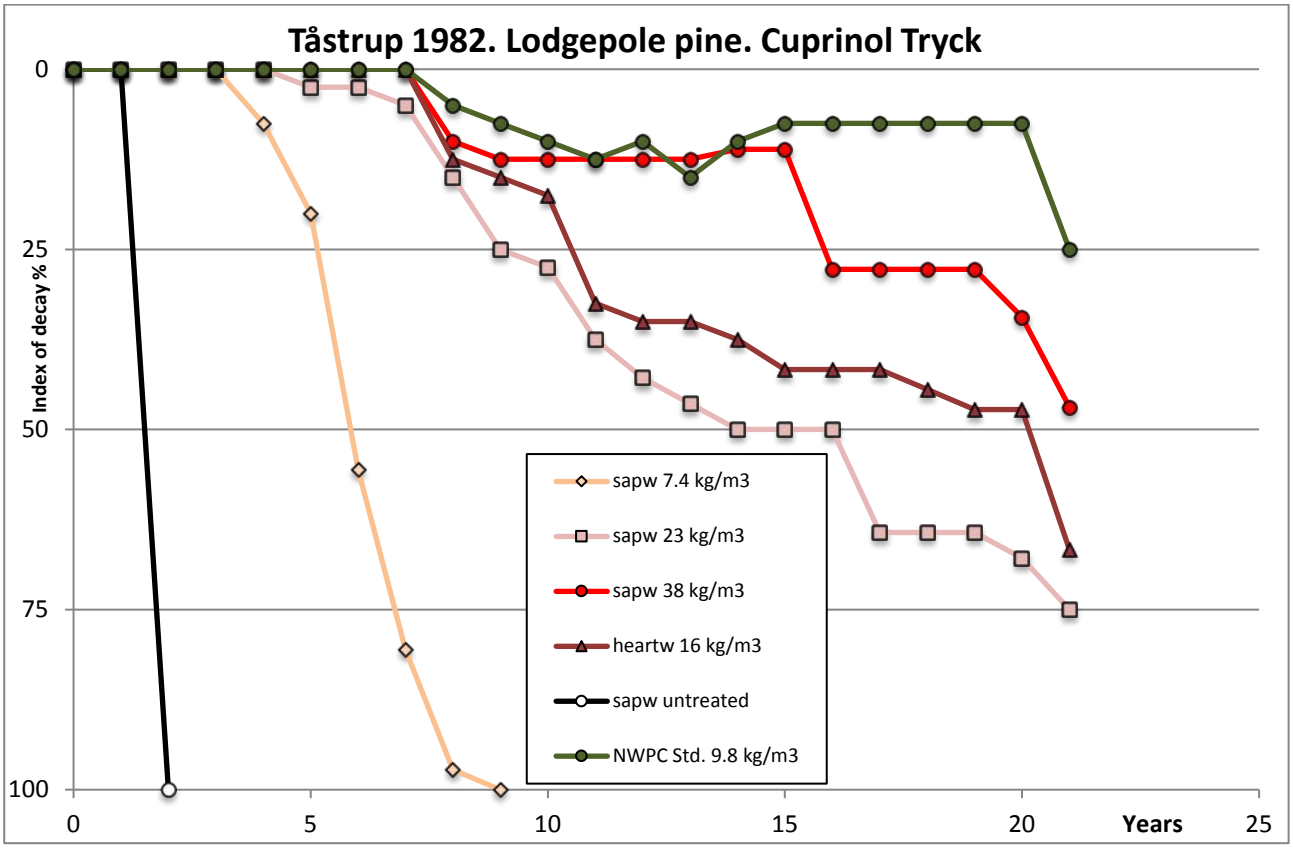
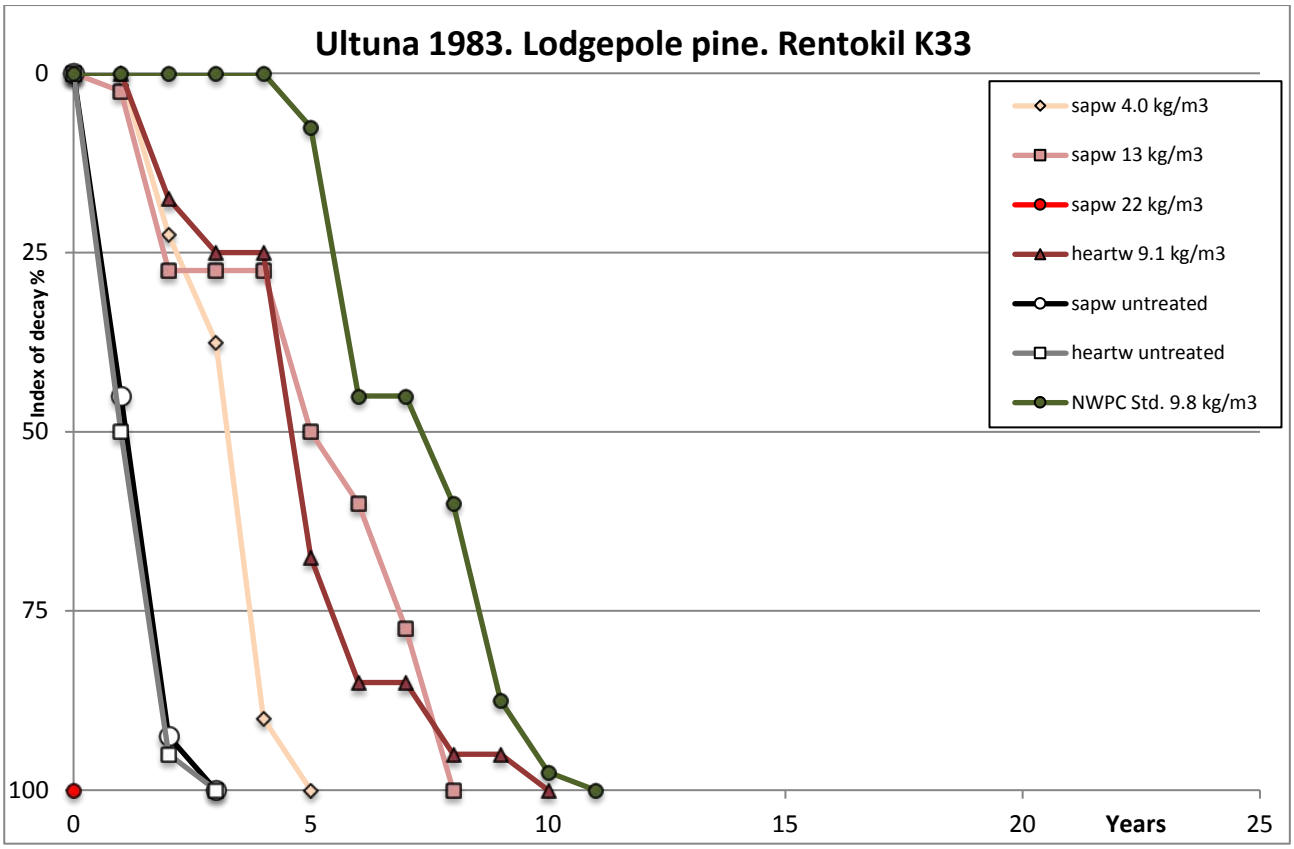


Figure 82. Field trial 1982-83. Index of decay for stakes of Lodgepole pine treated with Cuprinol Tryck.



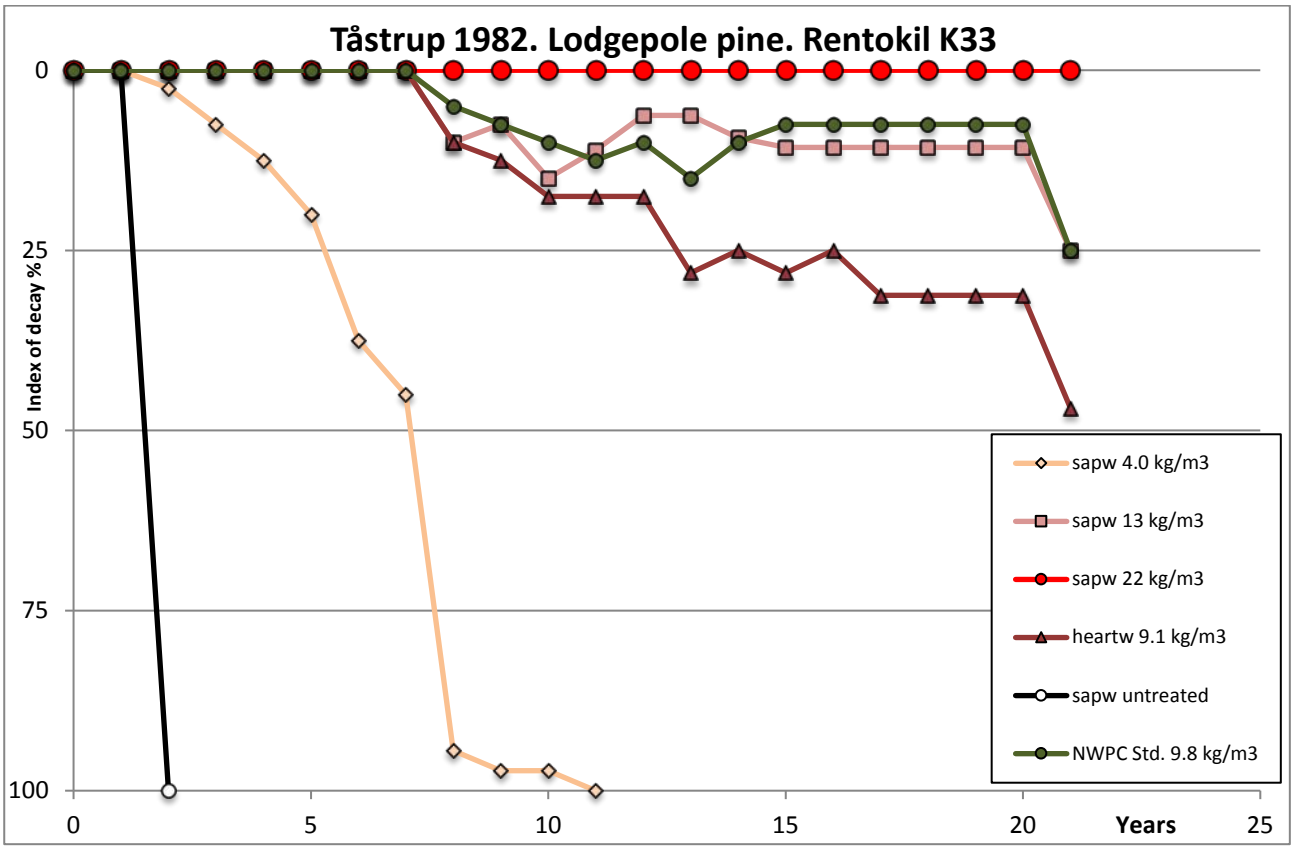
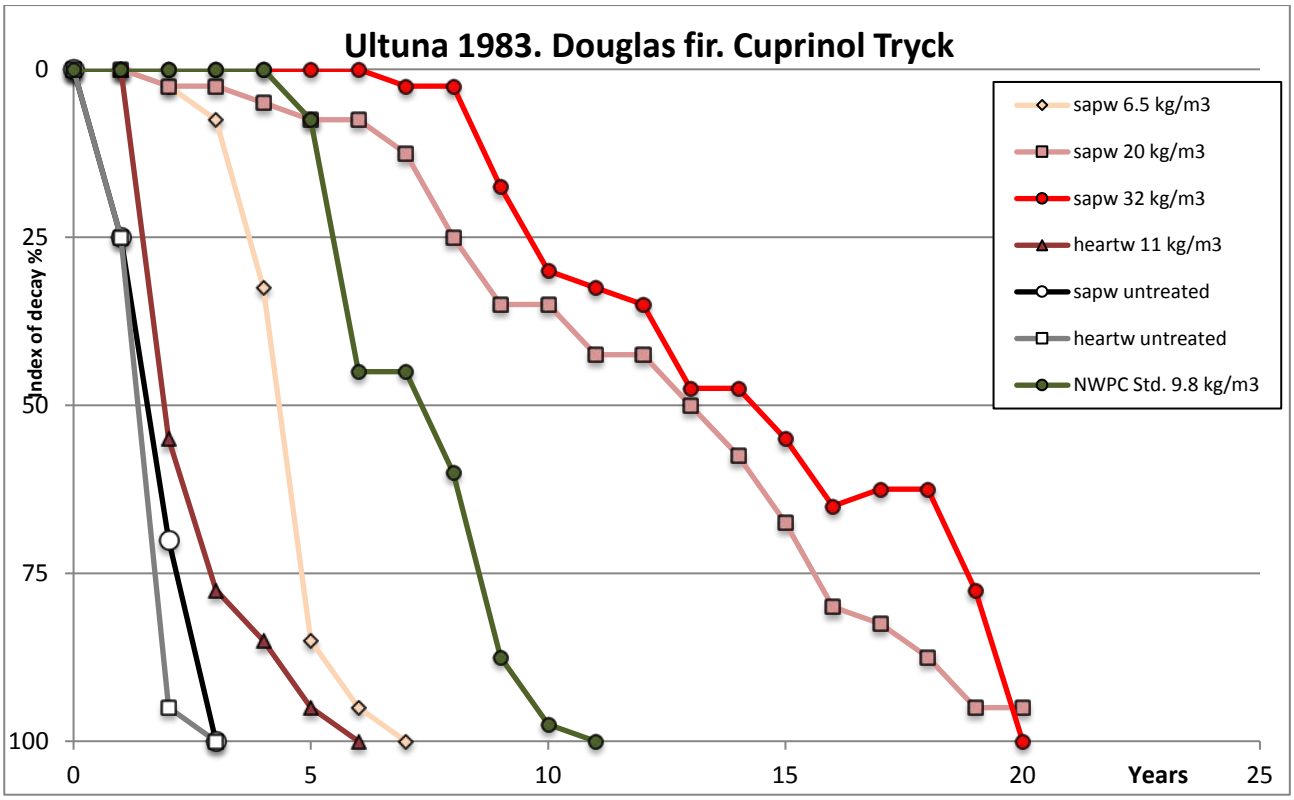


Figure 83. Field trial 1982-83. Index of decay for stakes of Lodgepole pine treated with Rentokil K33.



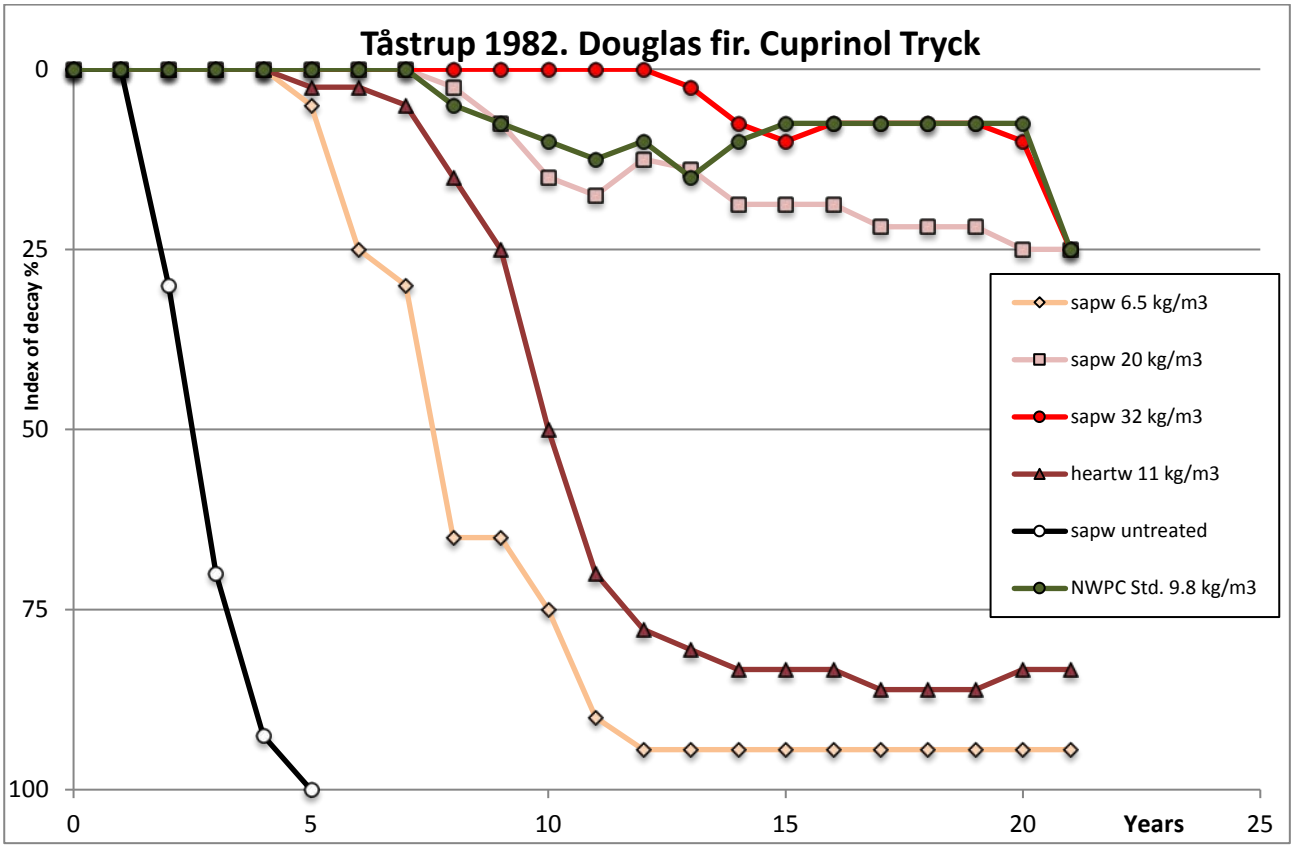
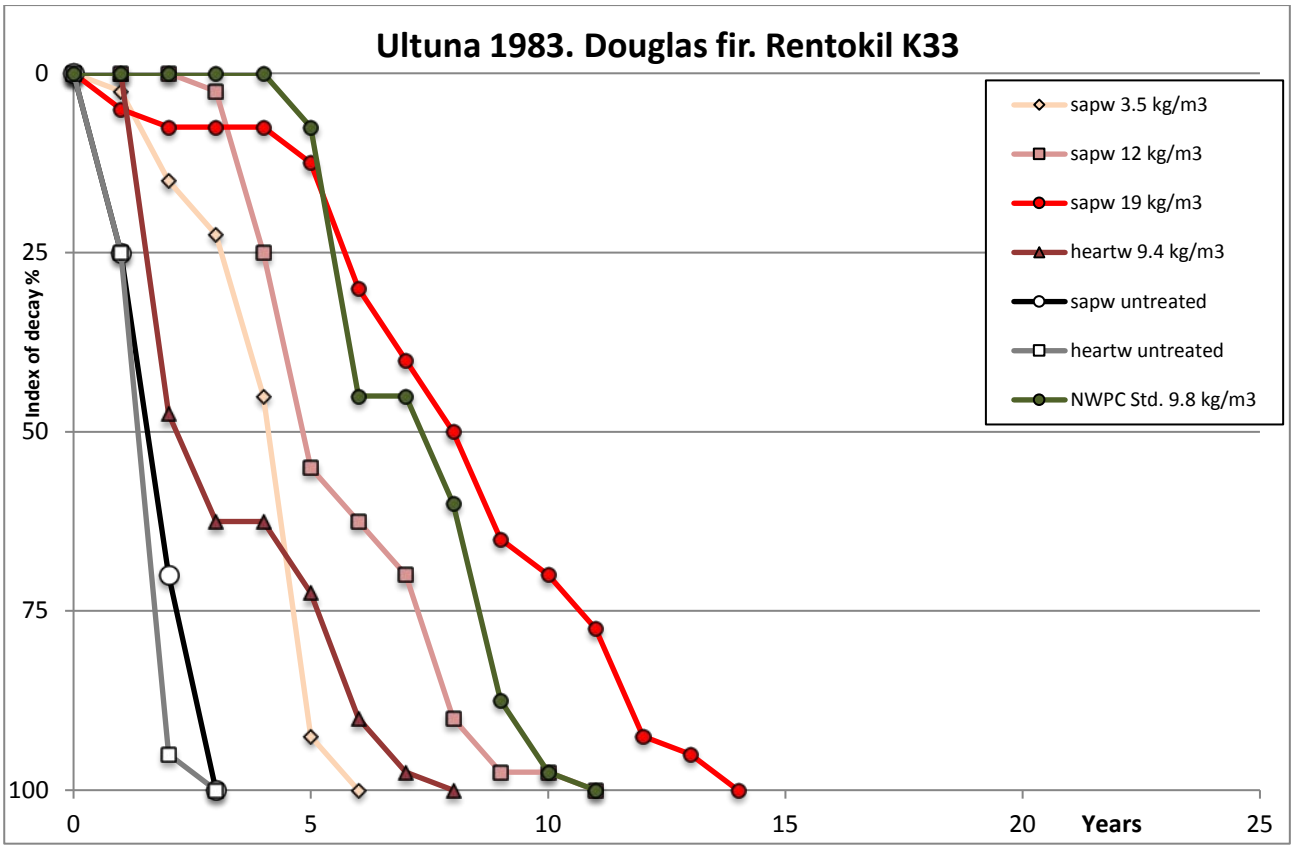


Figure 84. Field trial 1982-83. Index of decay for stakes of Douglas fir treated with Cuprinol Tryck.



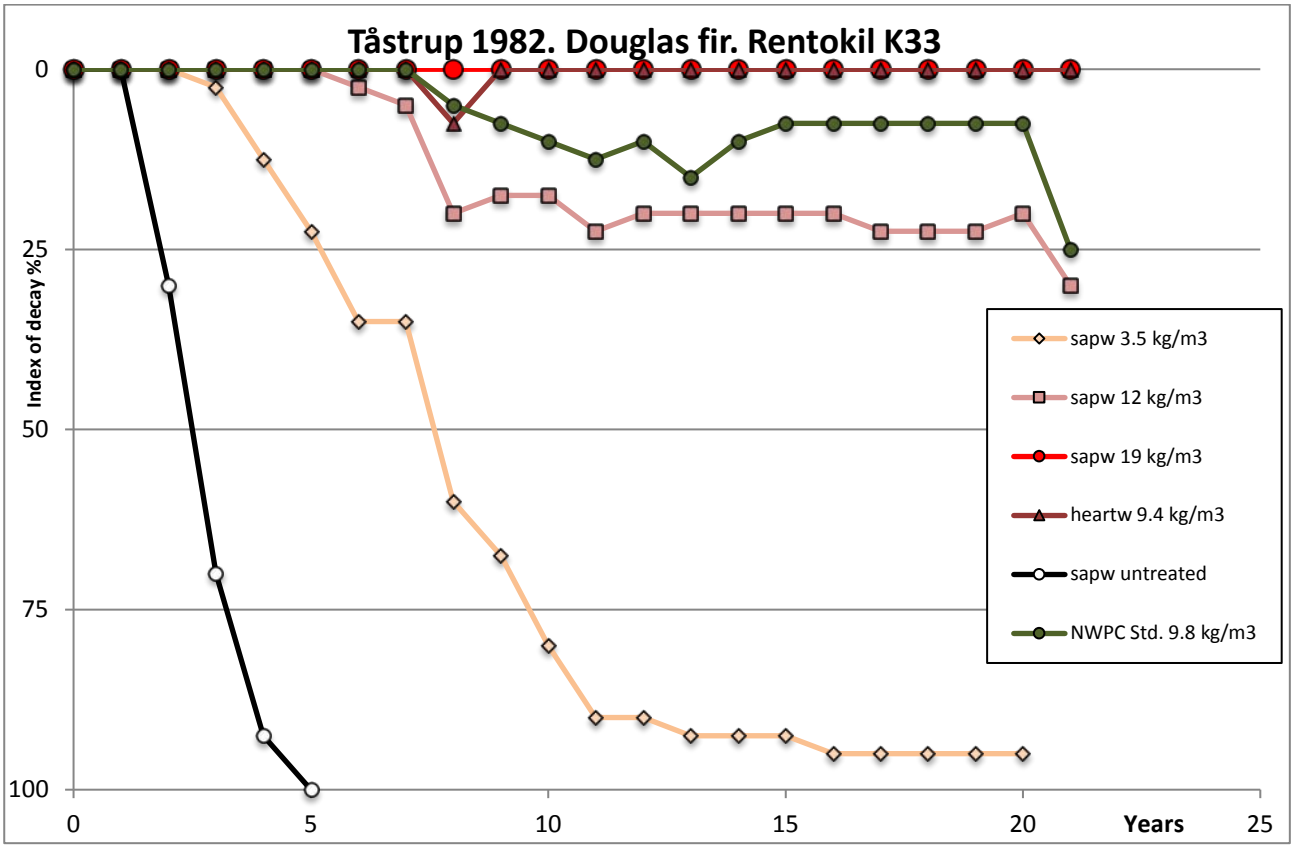
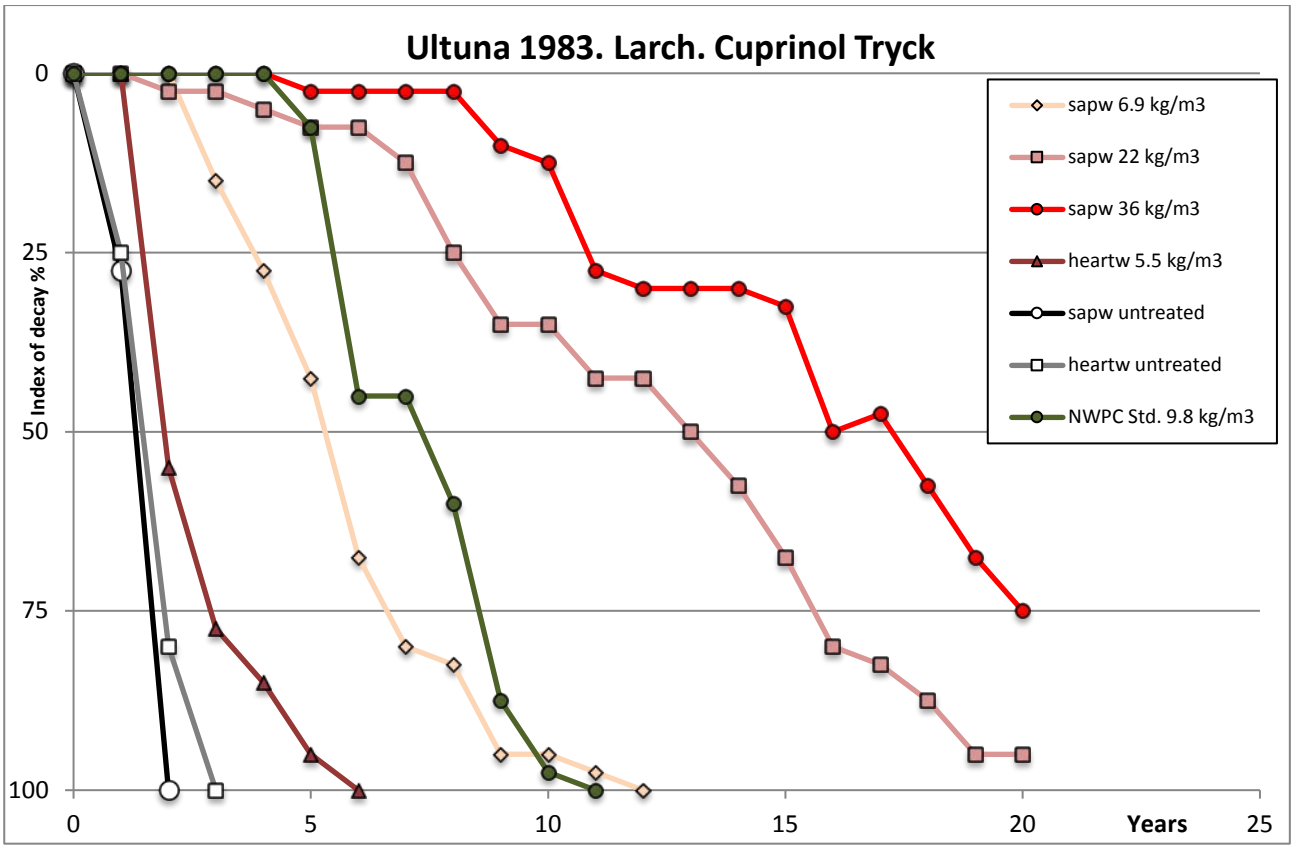


Figure 85. Field trial 1982-83. Index of decay for stakes of Douglas fir treated with Rentokil K33.



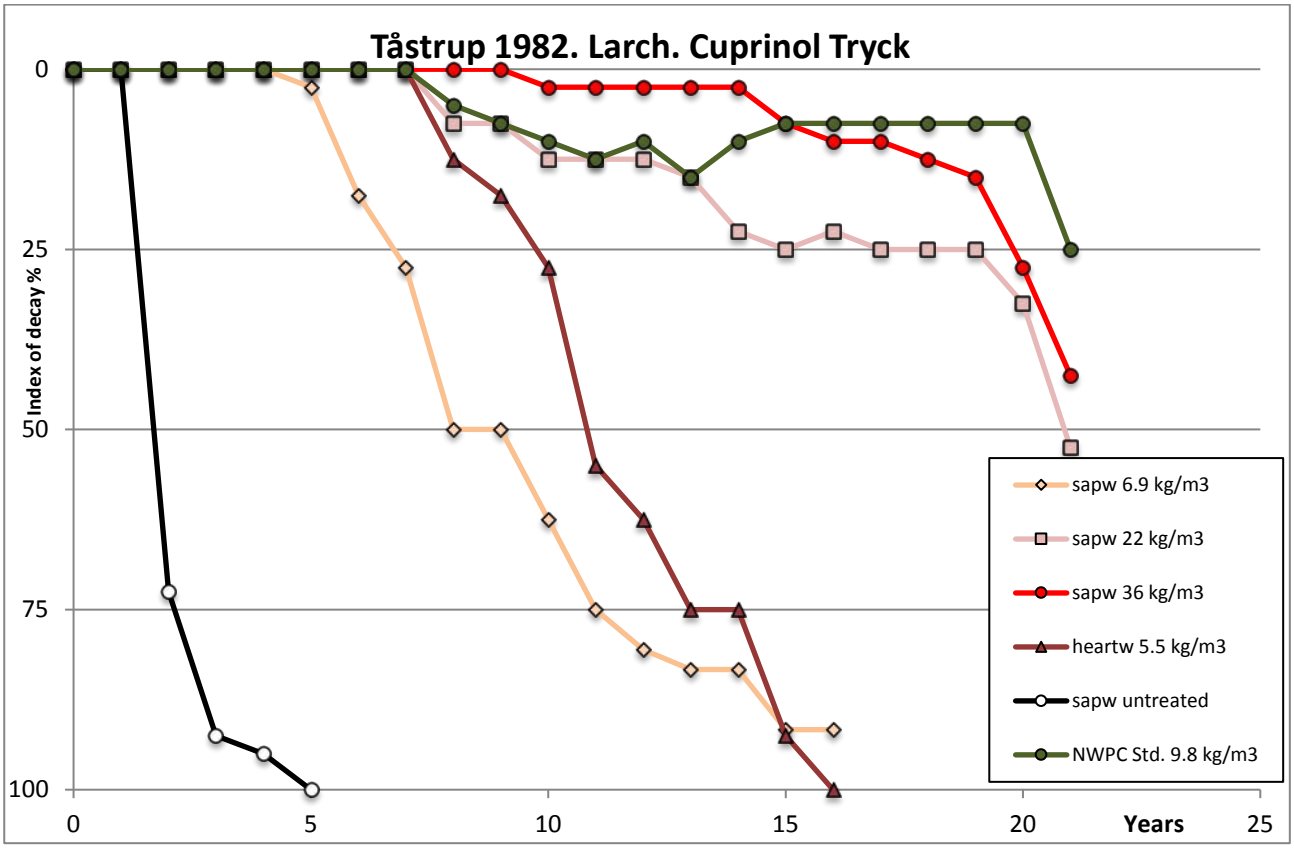
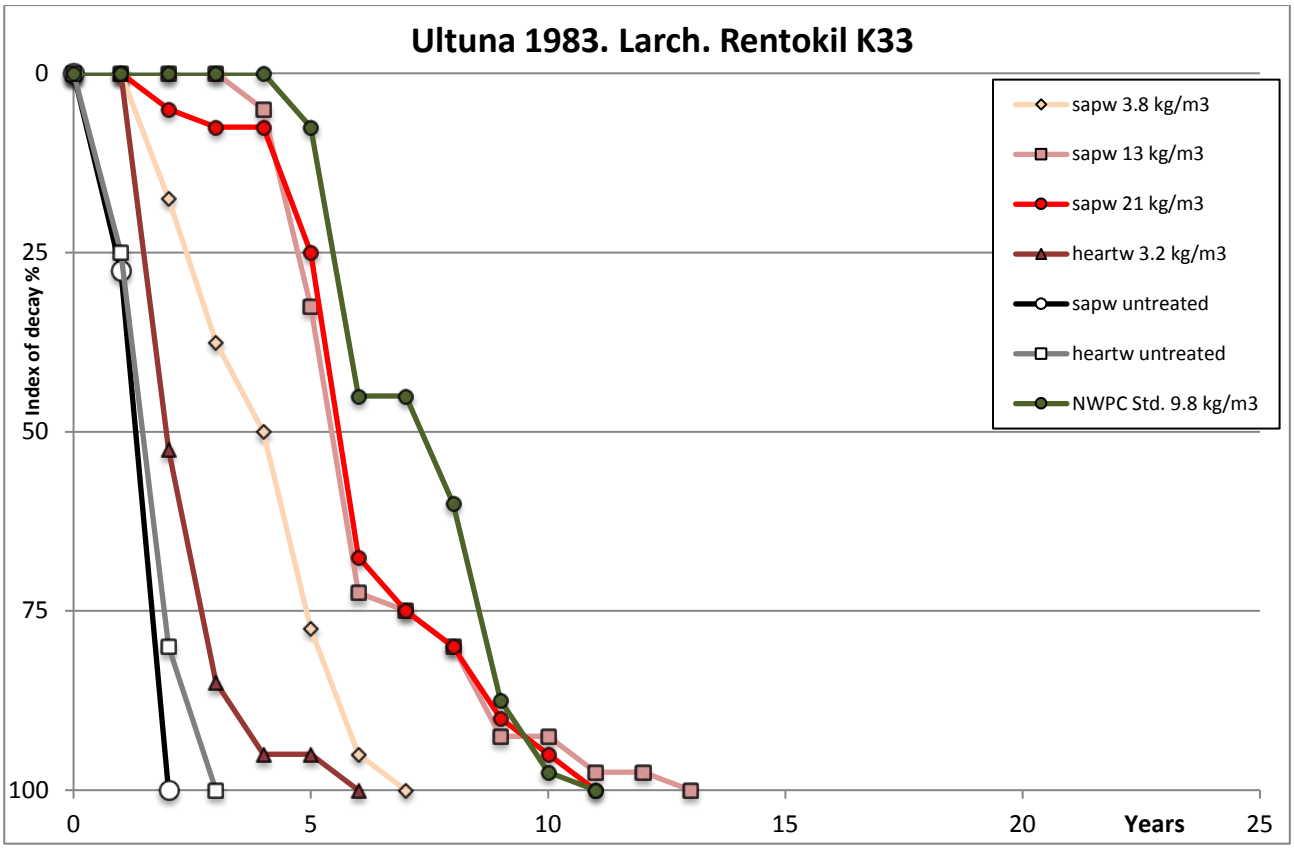


Figure 86. Field trial 1982-83. Index of decay for stakes of Larch treated with Cuprinol Tryck.



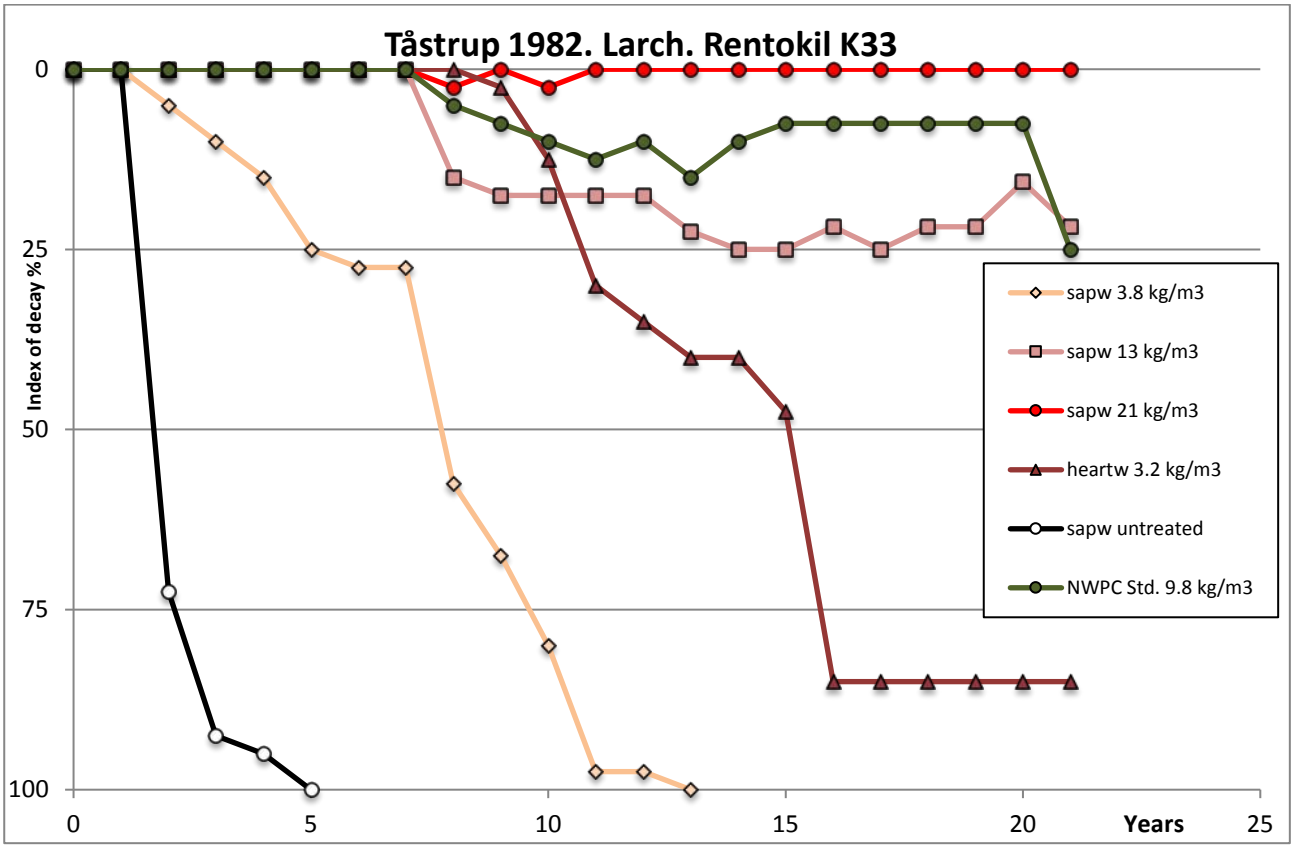
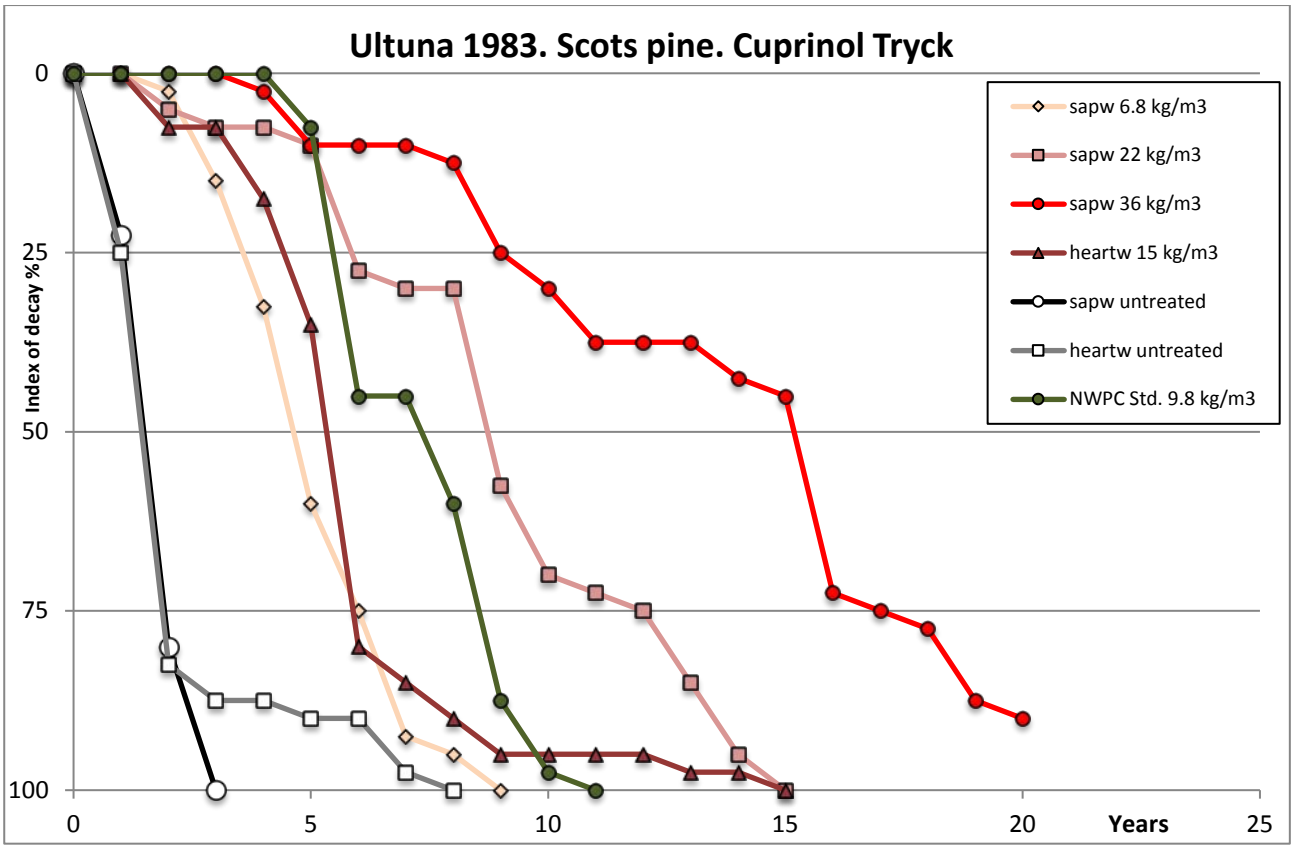


Figure 87. Field trial 1982-83. Index of decay for stakes of Larch treated with Rentokil K33.



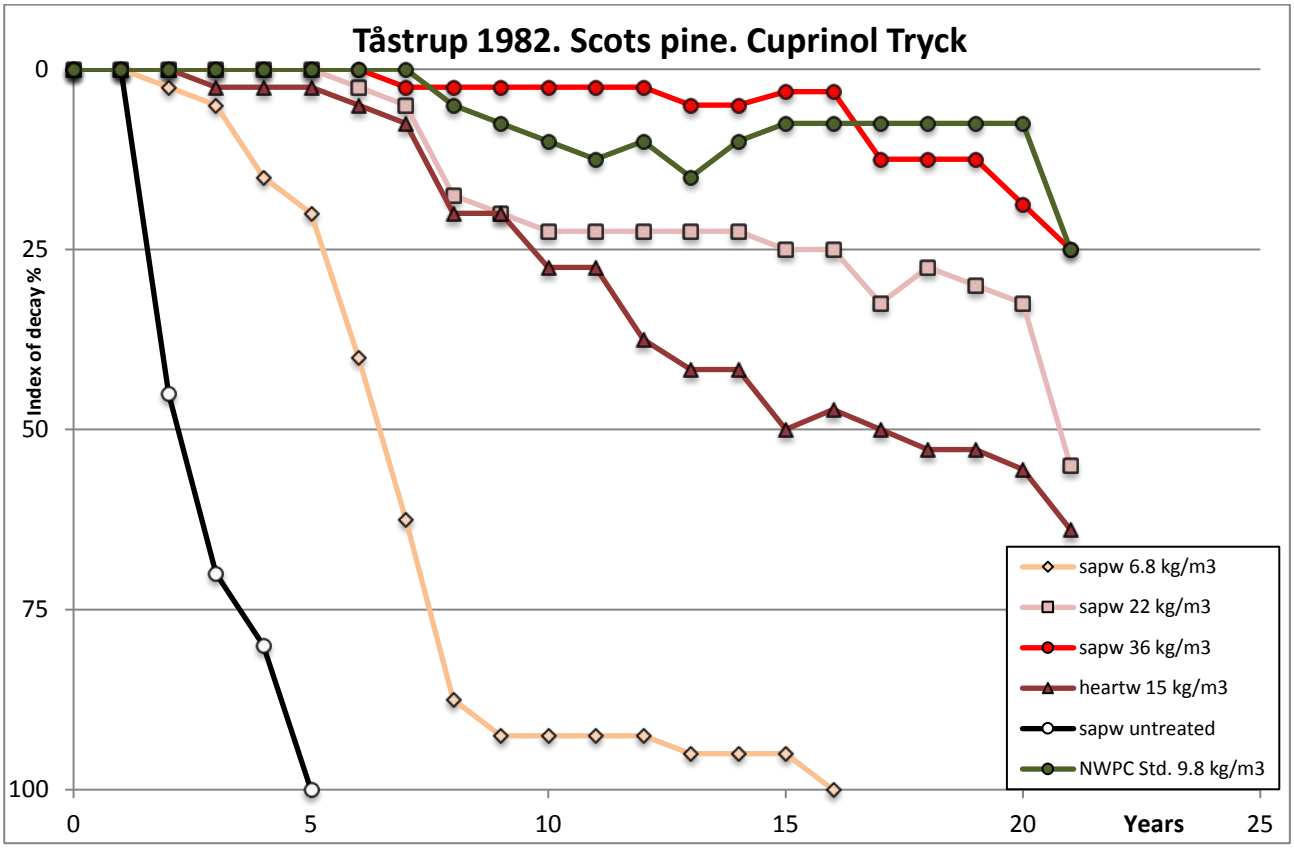
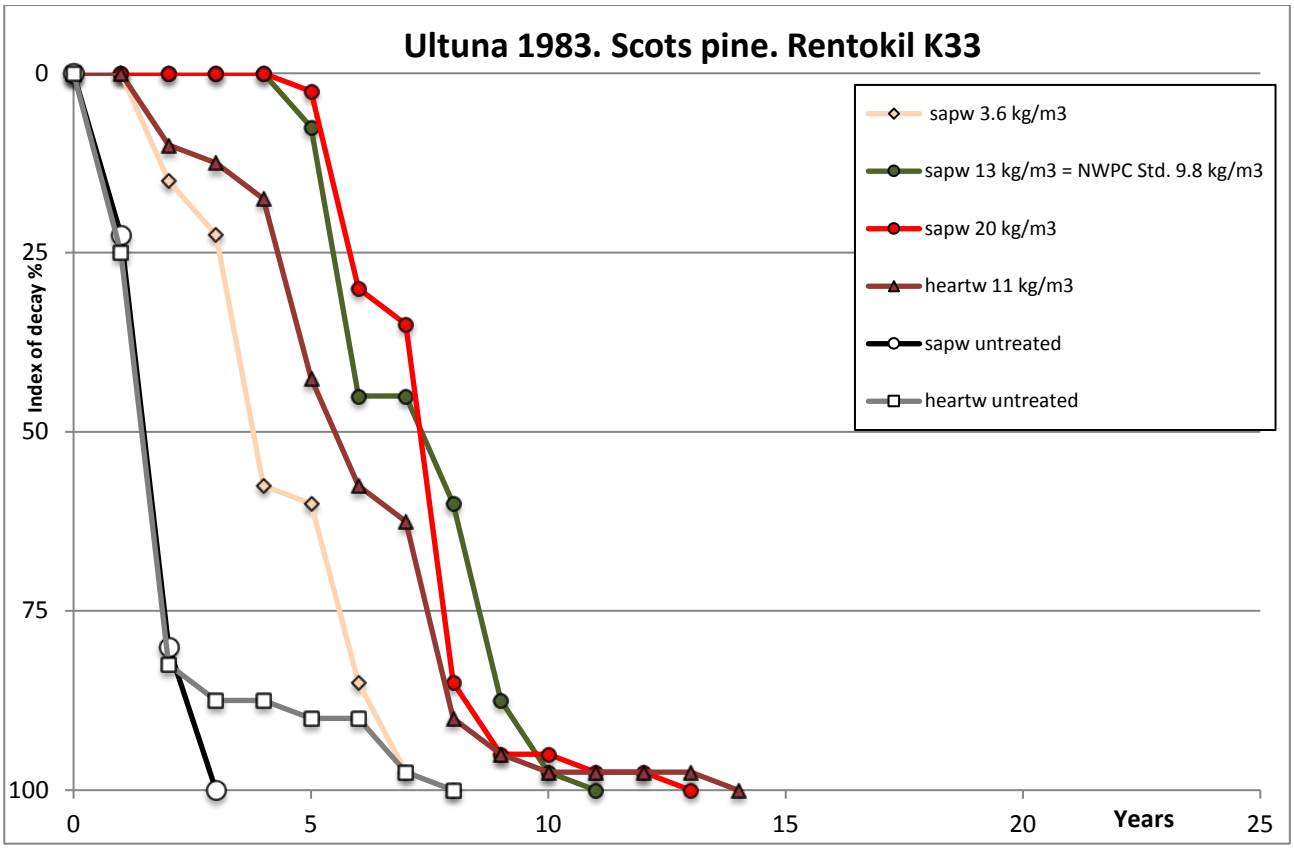


Figure 88. Field trial 1982-83. Index of decay for stakes of Scots pine treated with Cuprinol Tryck.



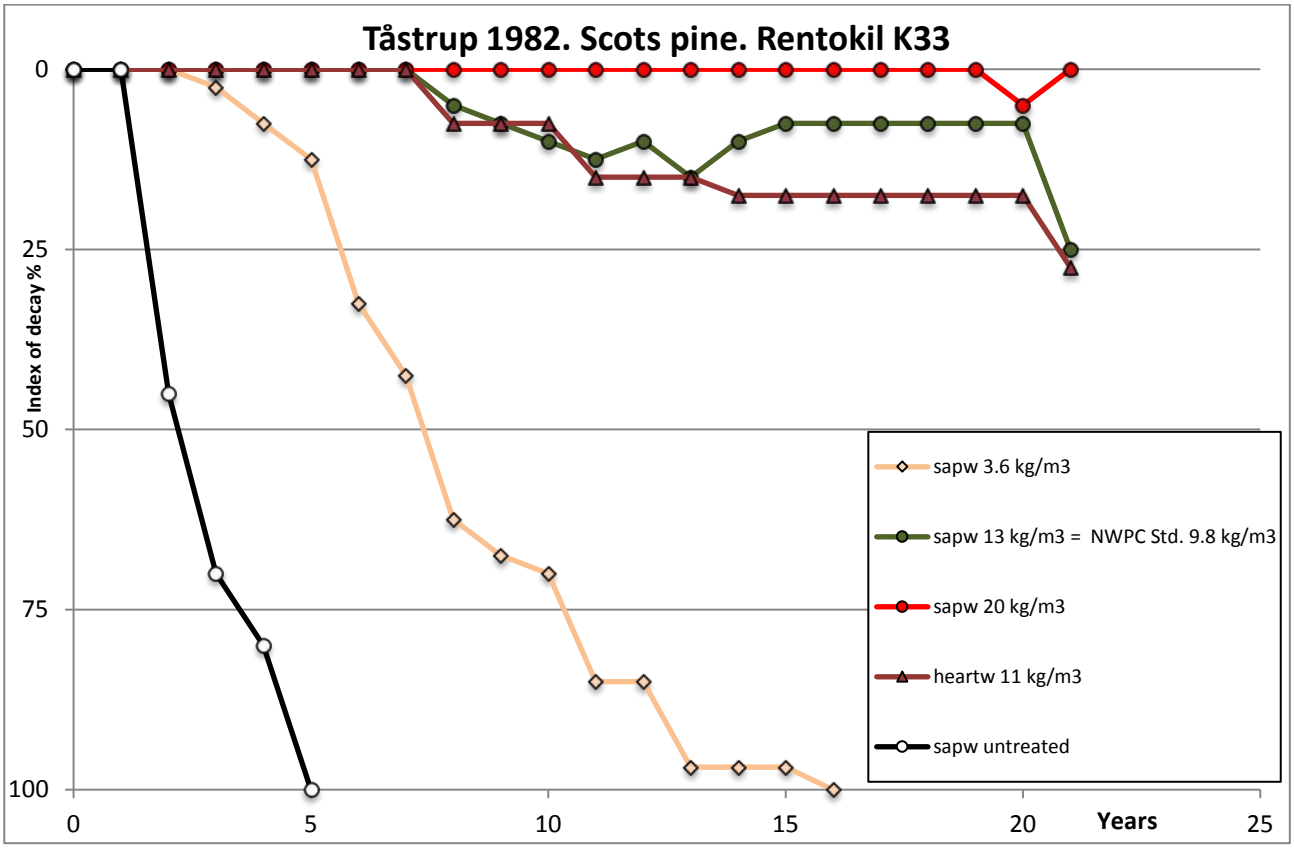
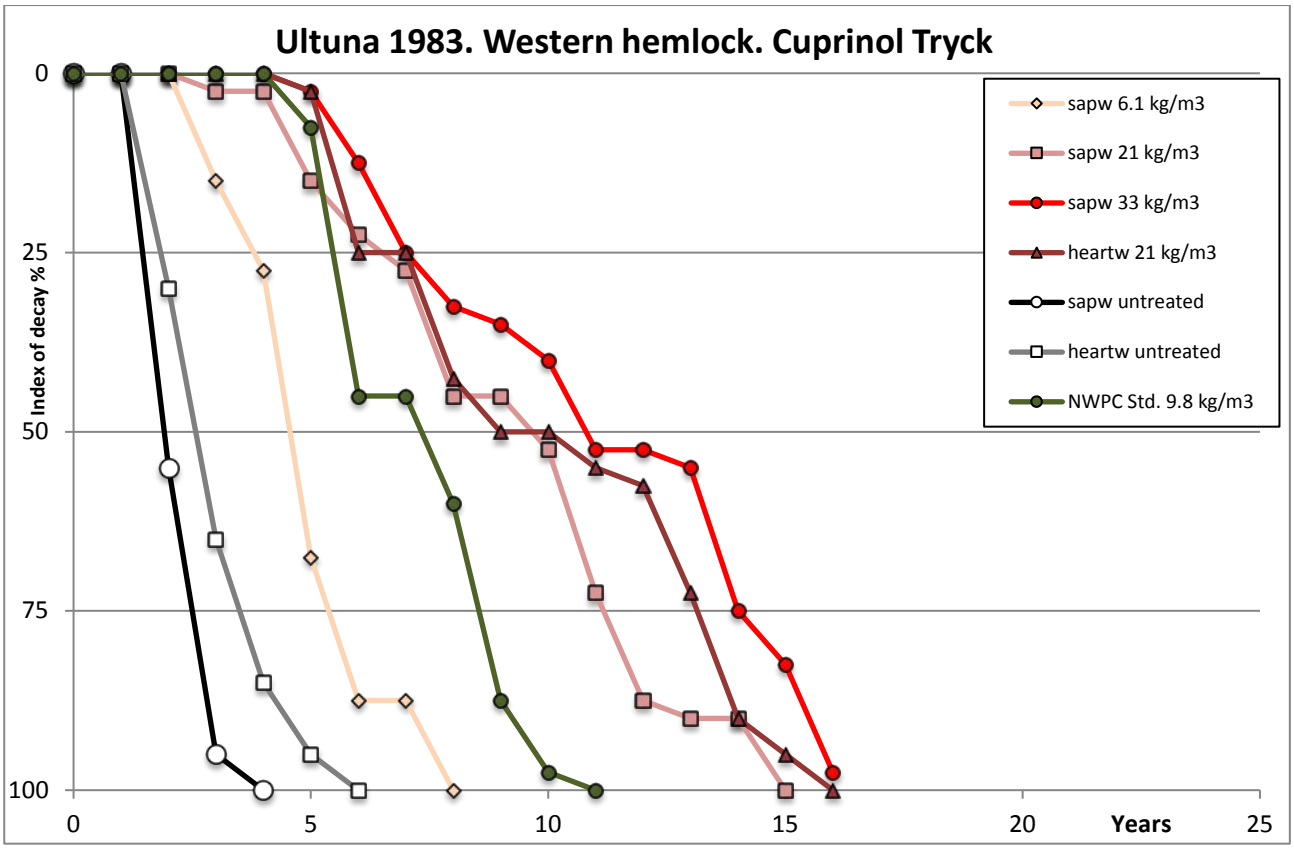


Figure 89. Field trial 1982-83. Index of decay for stakes of Scots pine treated with Rentokil K33.



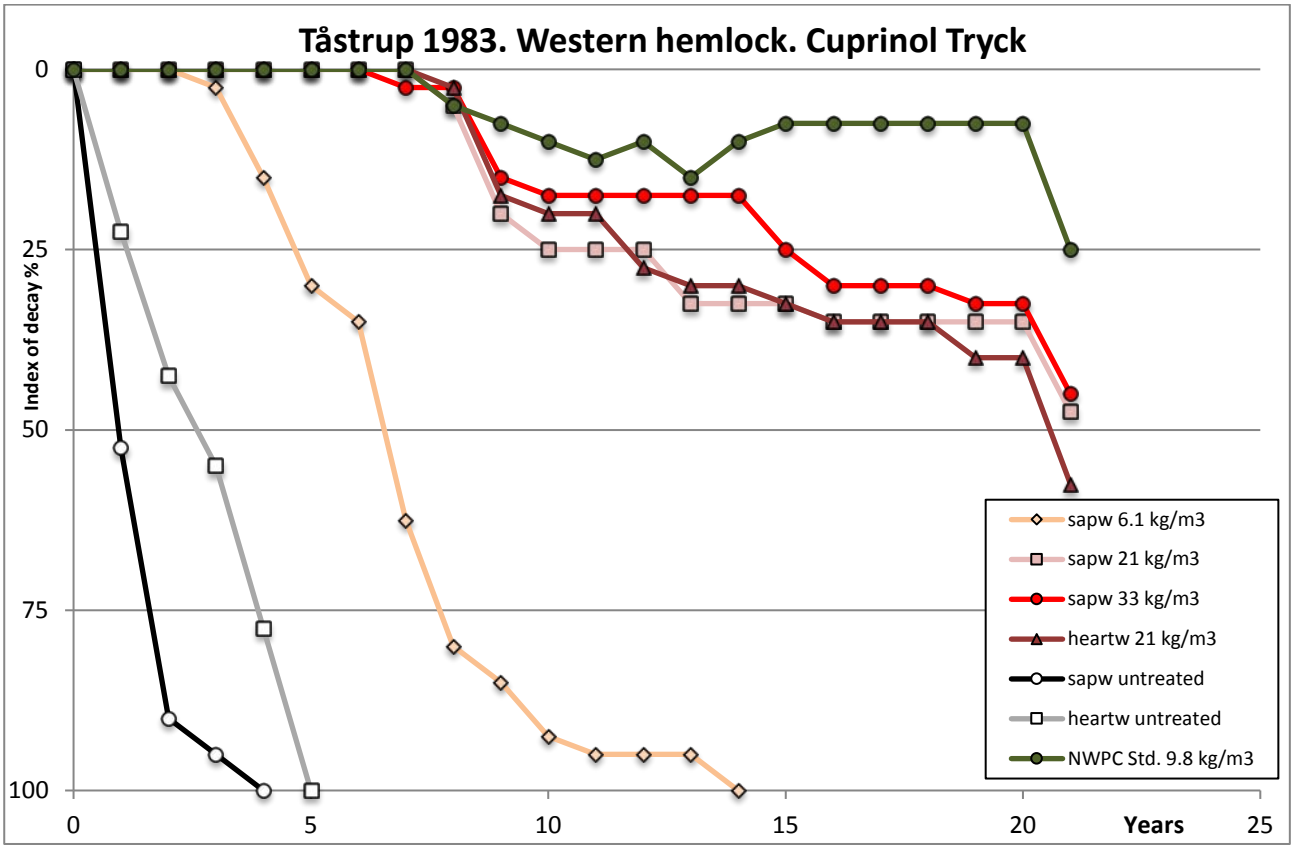


Figure 90. Field trial 1982-83. Index of decay for stakes of Western hemlock treated with Cuprinol Tryck.

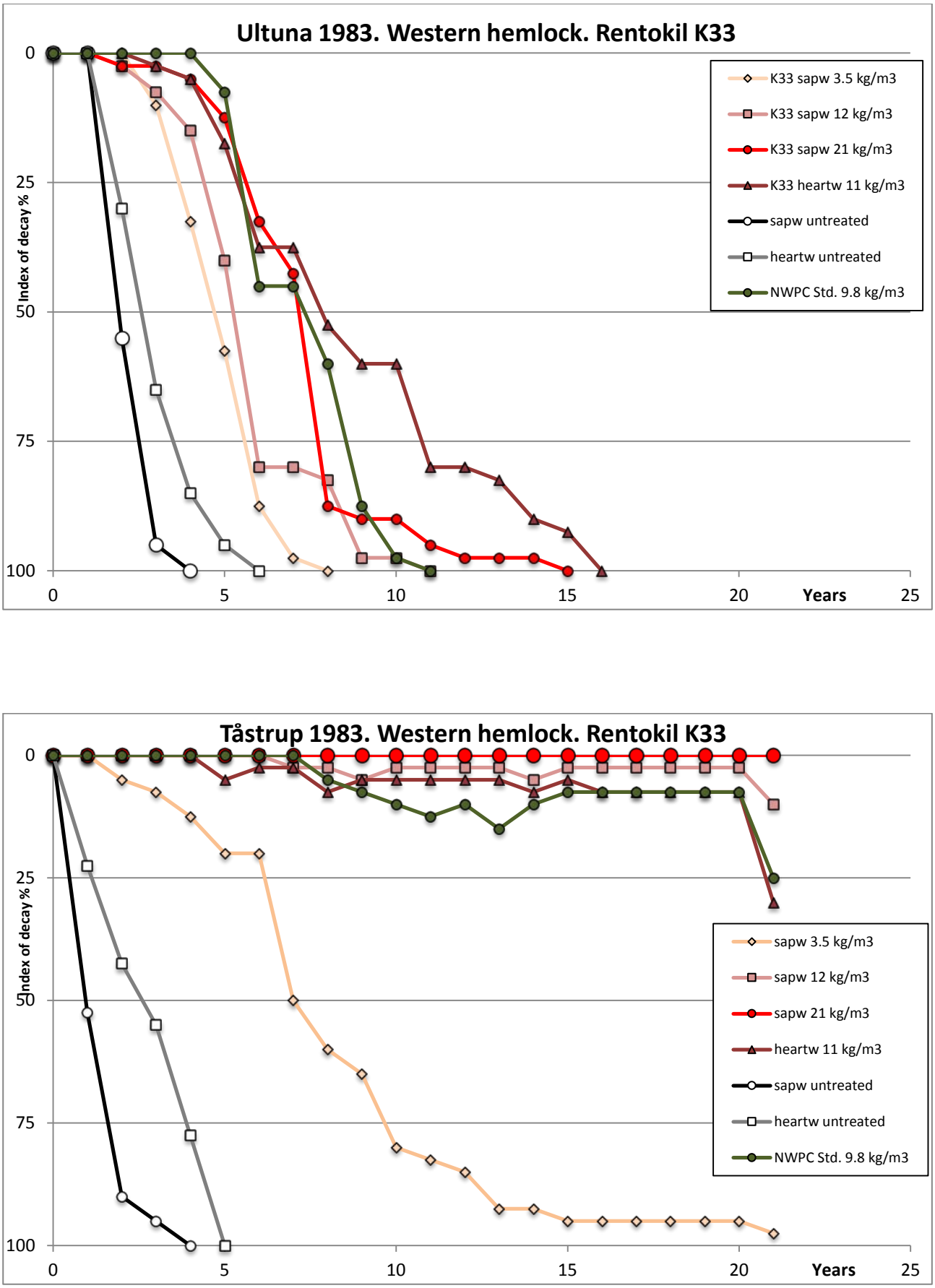


Figure 91. Field trial 1982-83. Index of decay for stakes of Western hemlock treated with Rentokil K33.

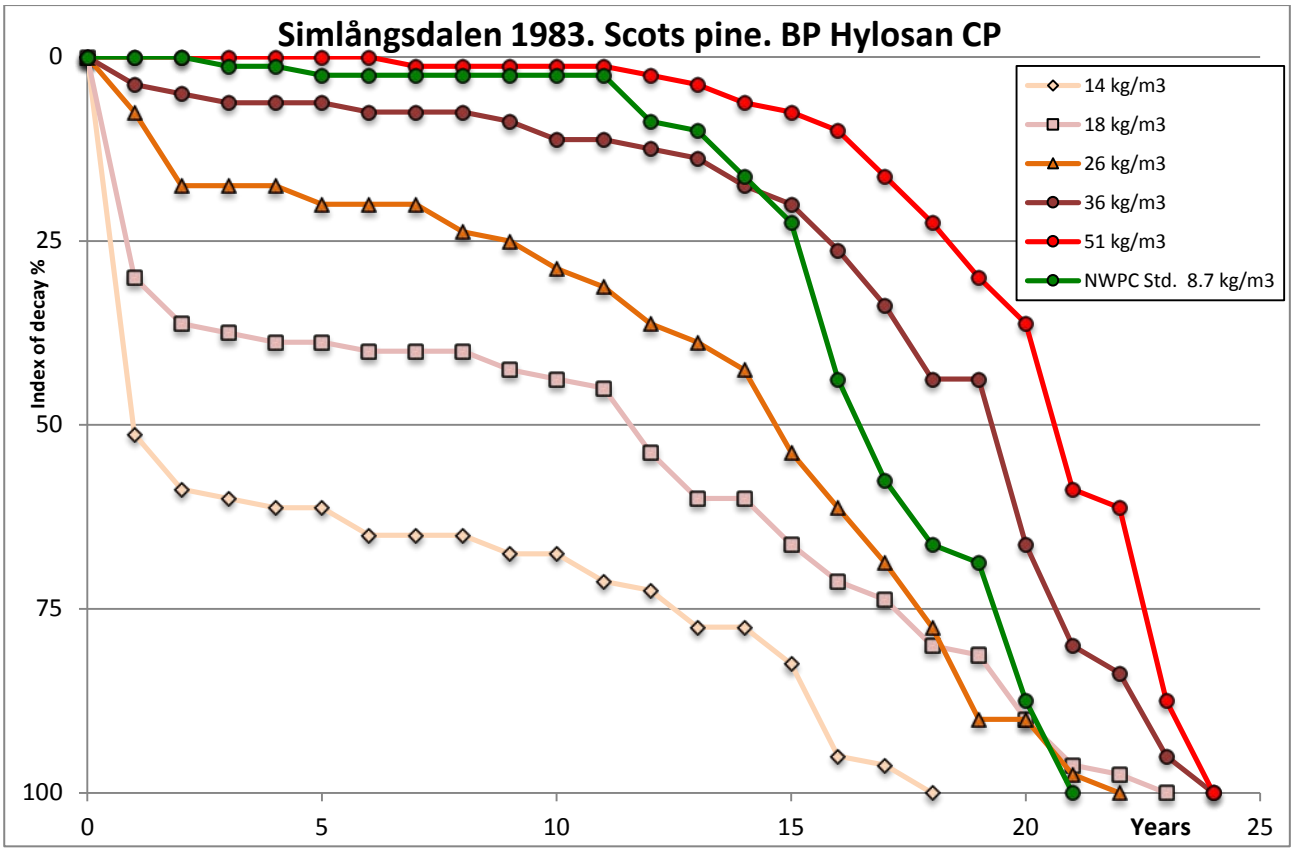
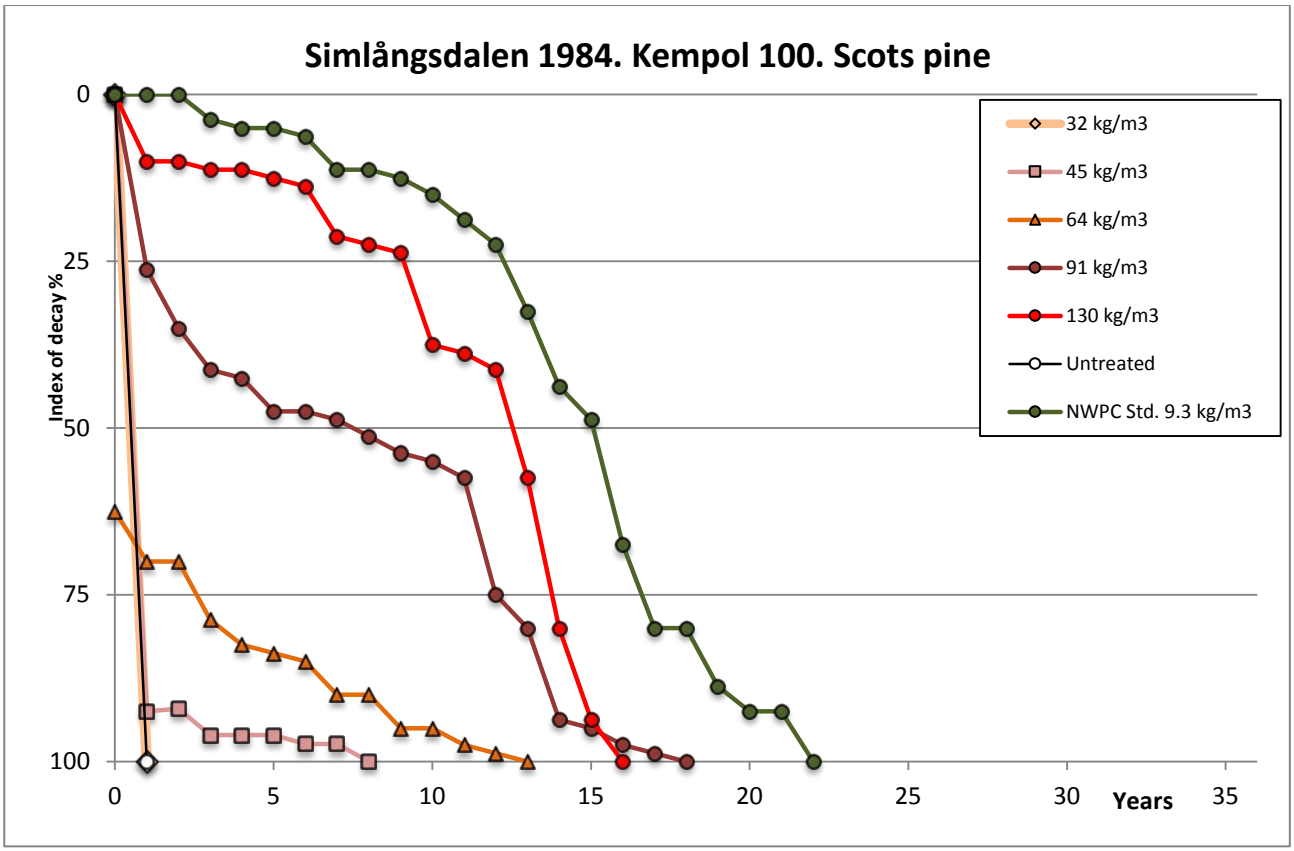


Figure 92. Field trial 1983. Index of decay for stakes of Scots pine treated with BP Hylosan CP.



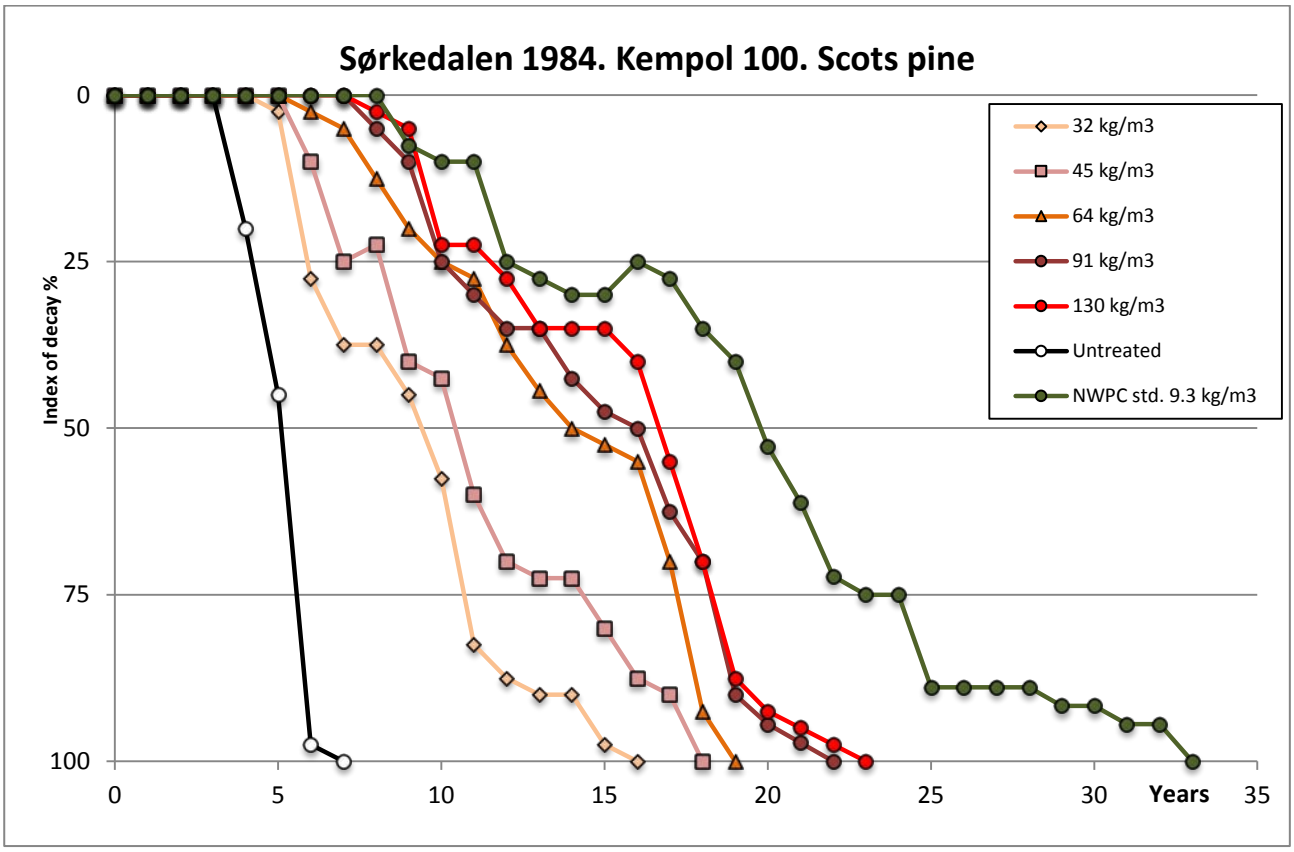
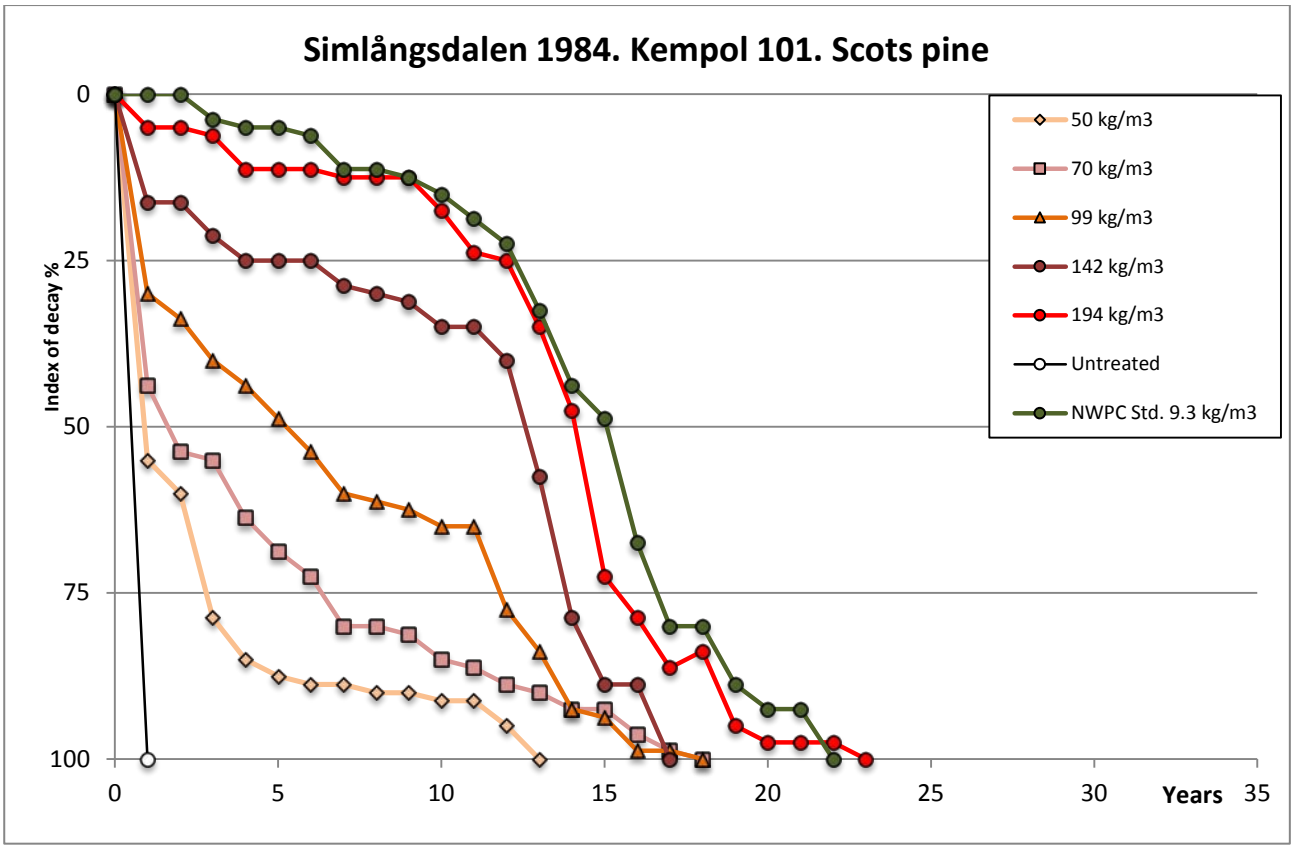


Figure 93. Field trial 1984. Index of decay for stakes of Scots pine treated with Kempol 100.



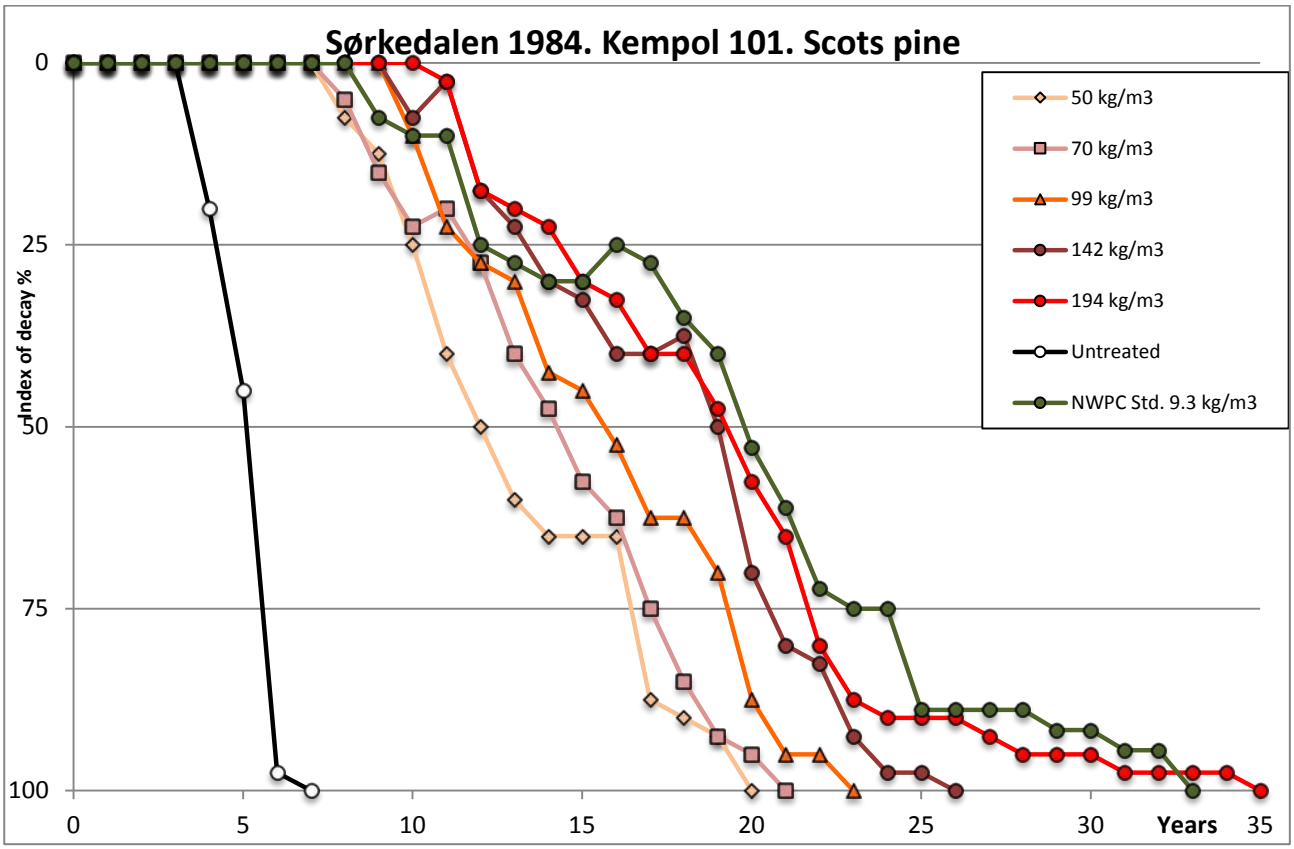
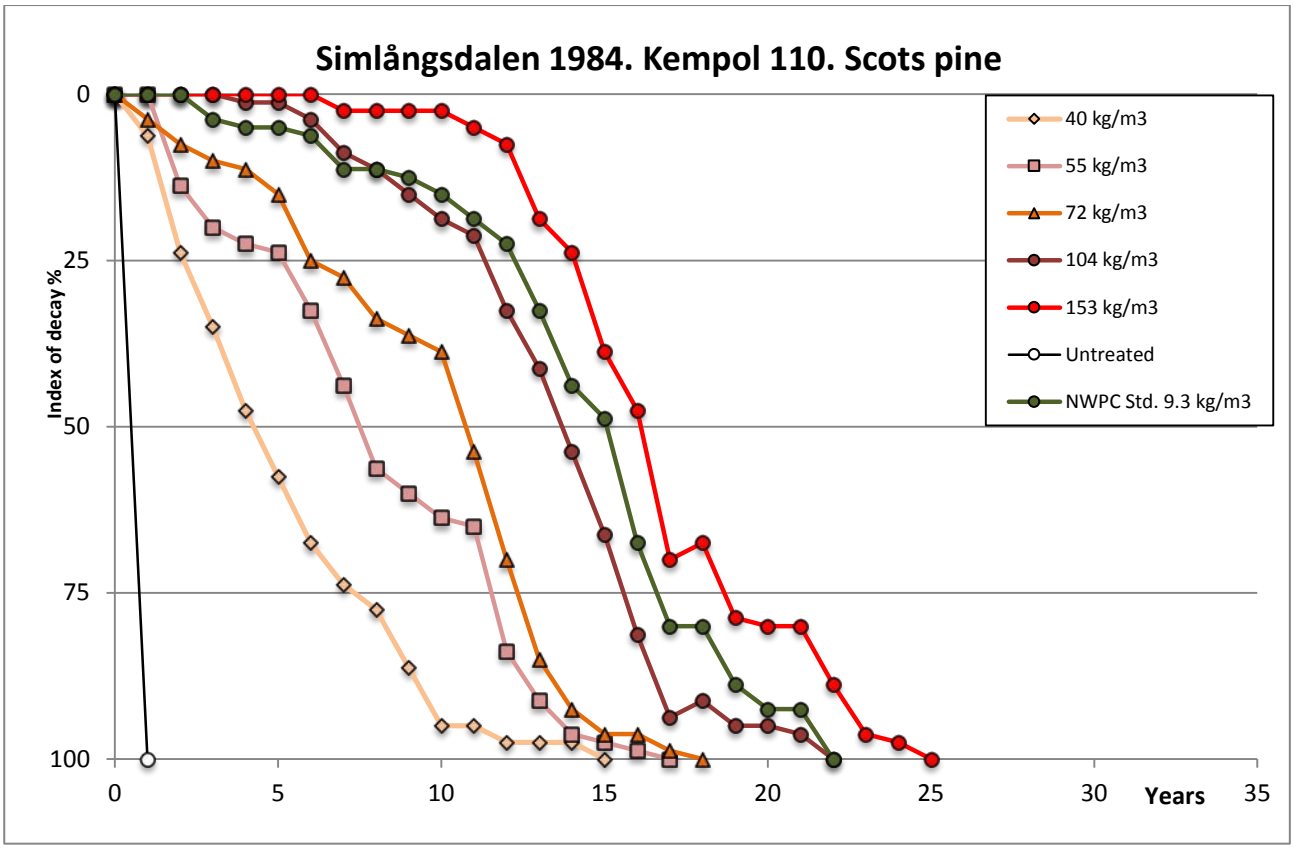


Figure 94. Field trial 1984. Index of decay for stakes of Scots pine treated with Kempol 101.



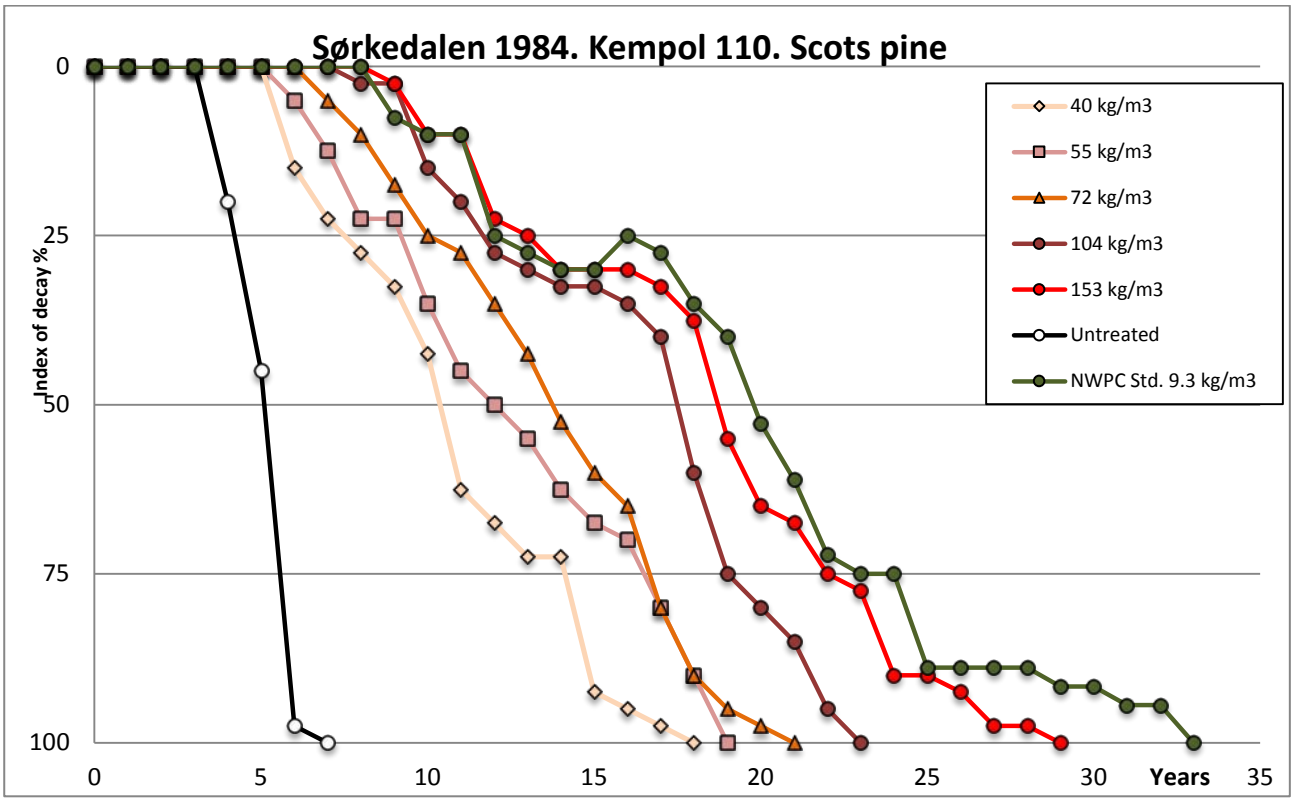
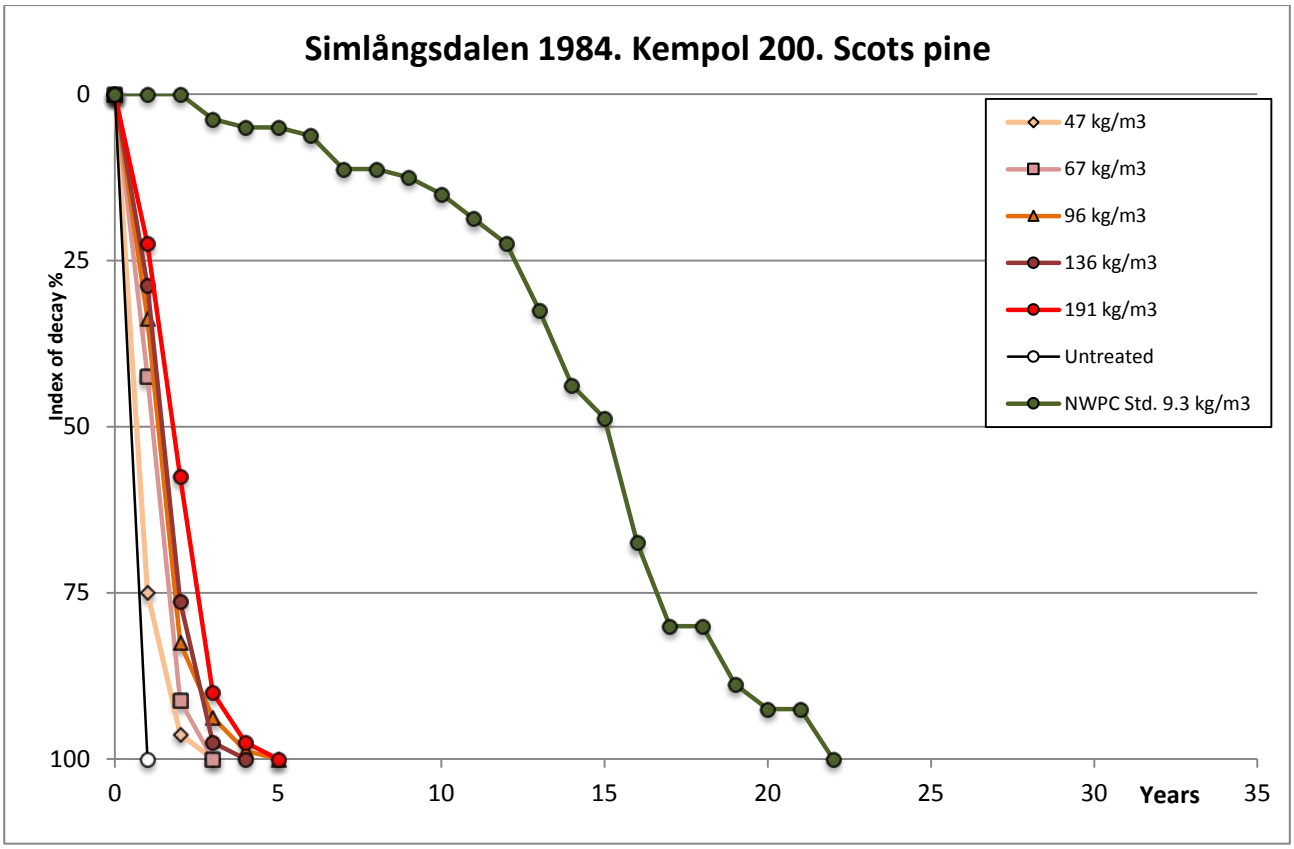


Figure 95. Field trial 1984. Index of decay for stakes of Scots pine treated with Kempol 110.



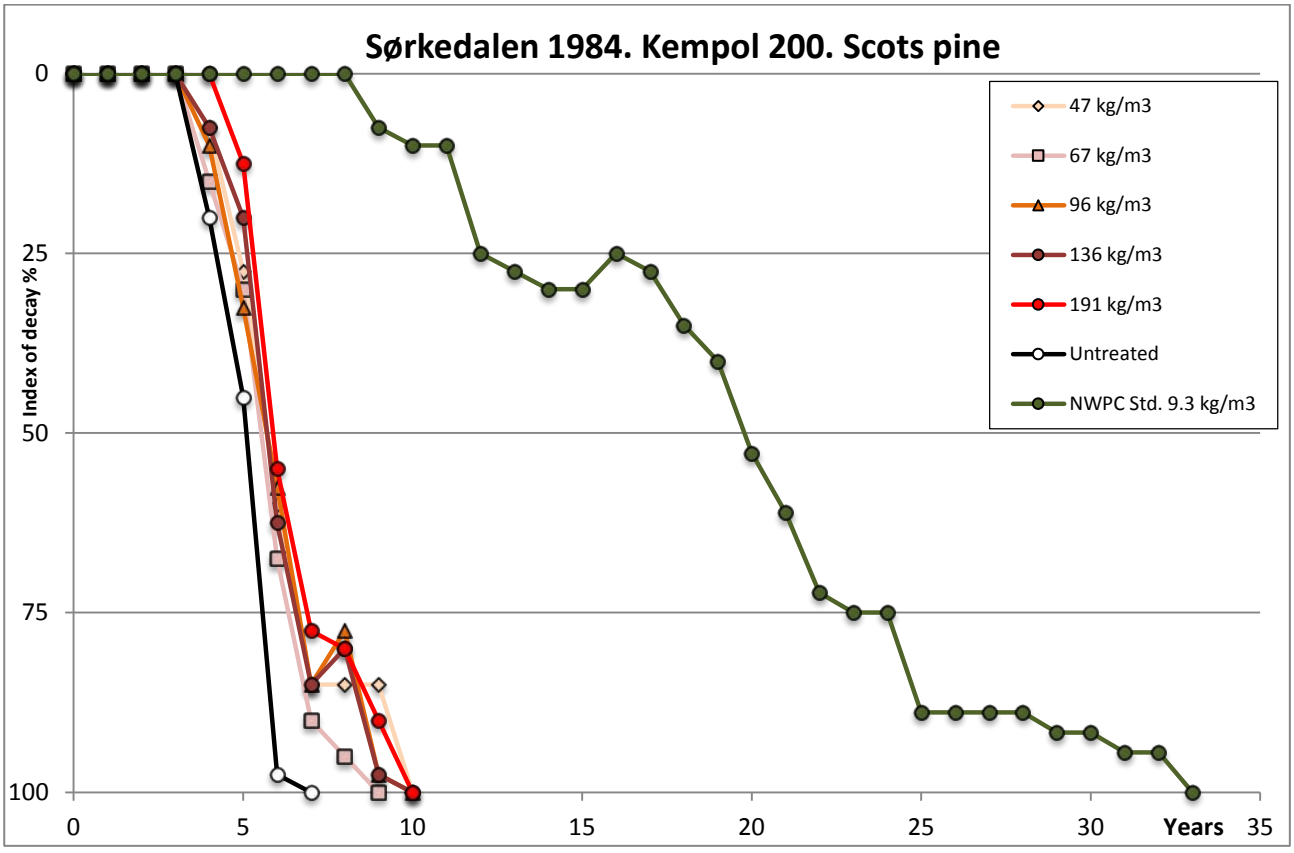
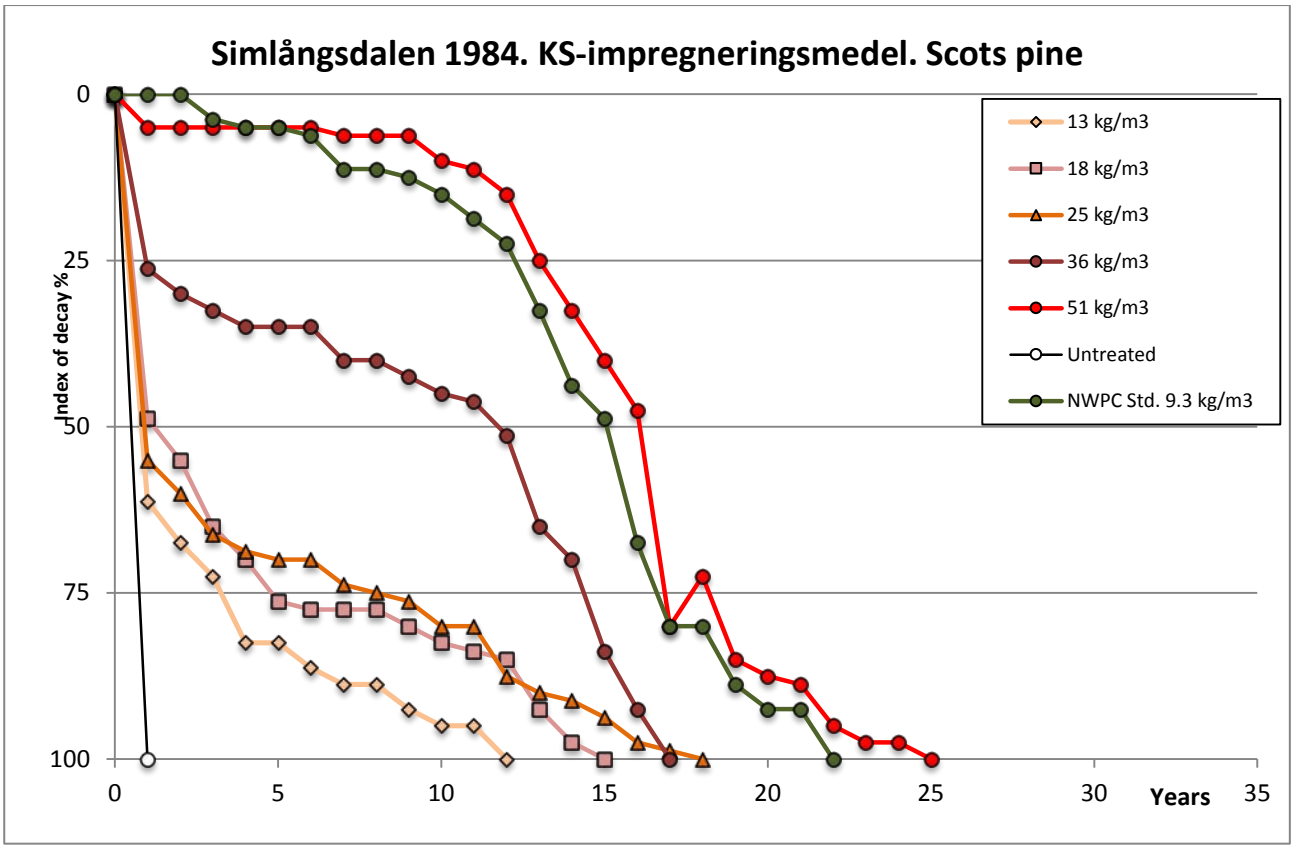


Figure 96. Field trial 1984. Index of decay for stakes of Scots pine treated with Kempol 200.



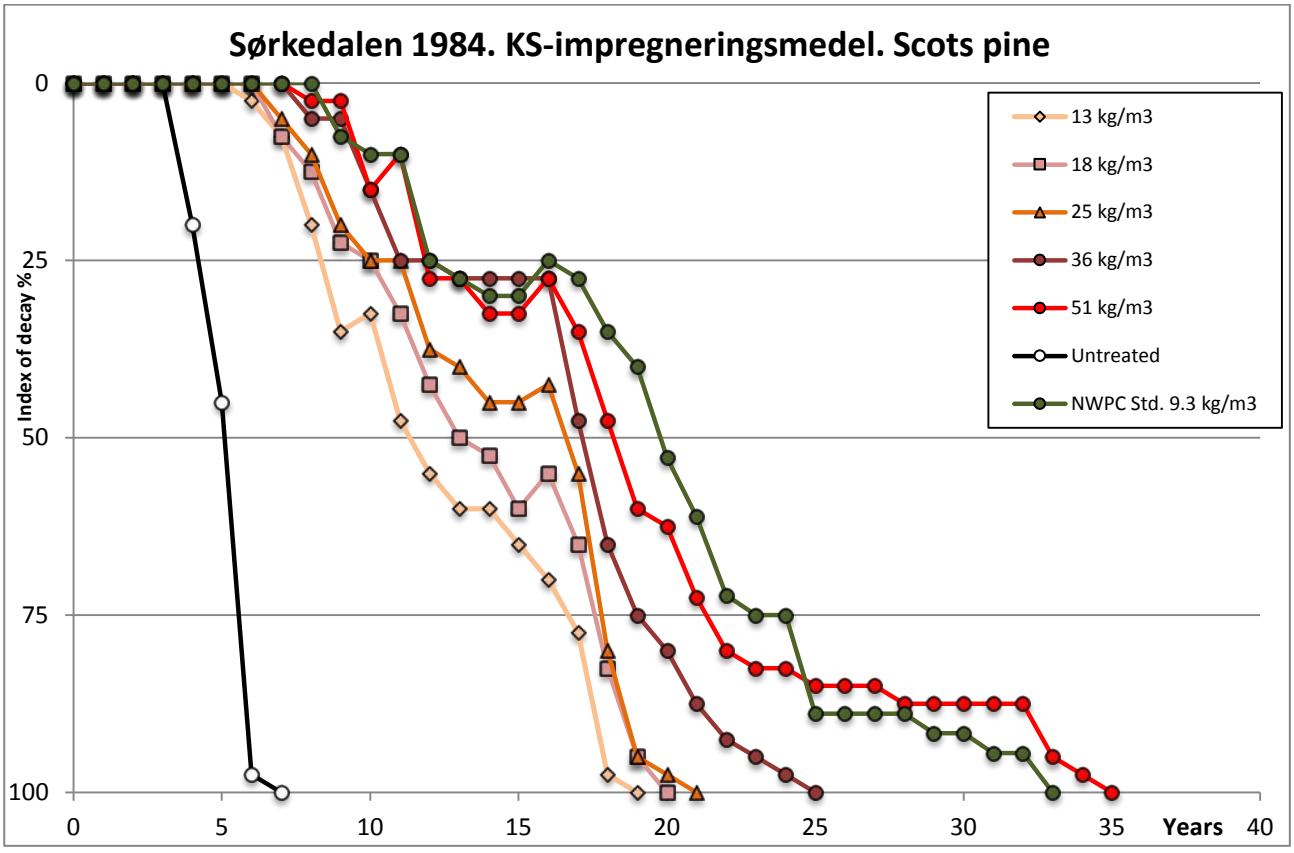
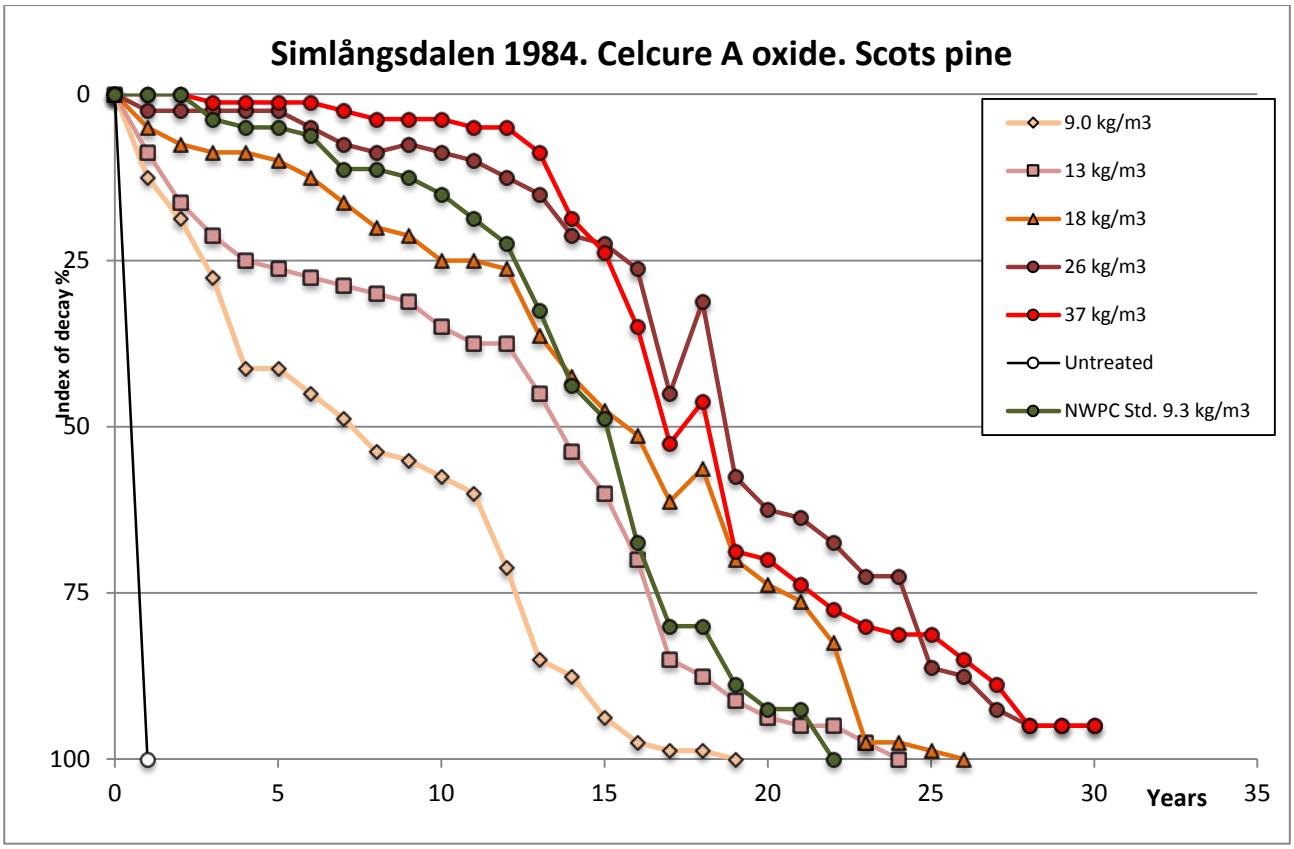


Figure 97. Field trial 1984. Index of decay for stakes of Scots pine treated with KS-impregnerings-medel.



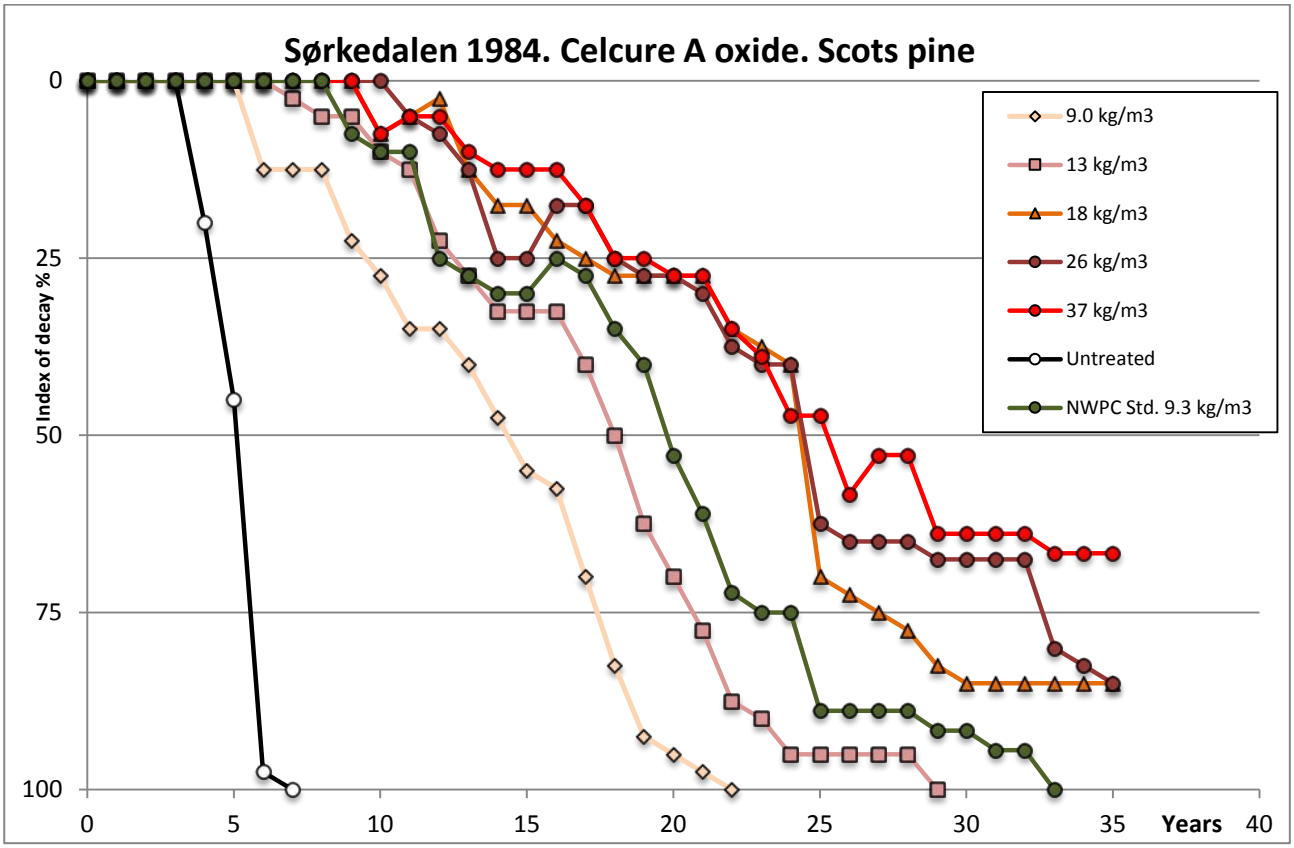
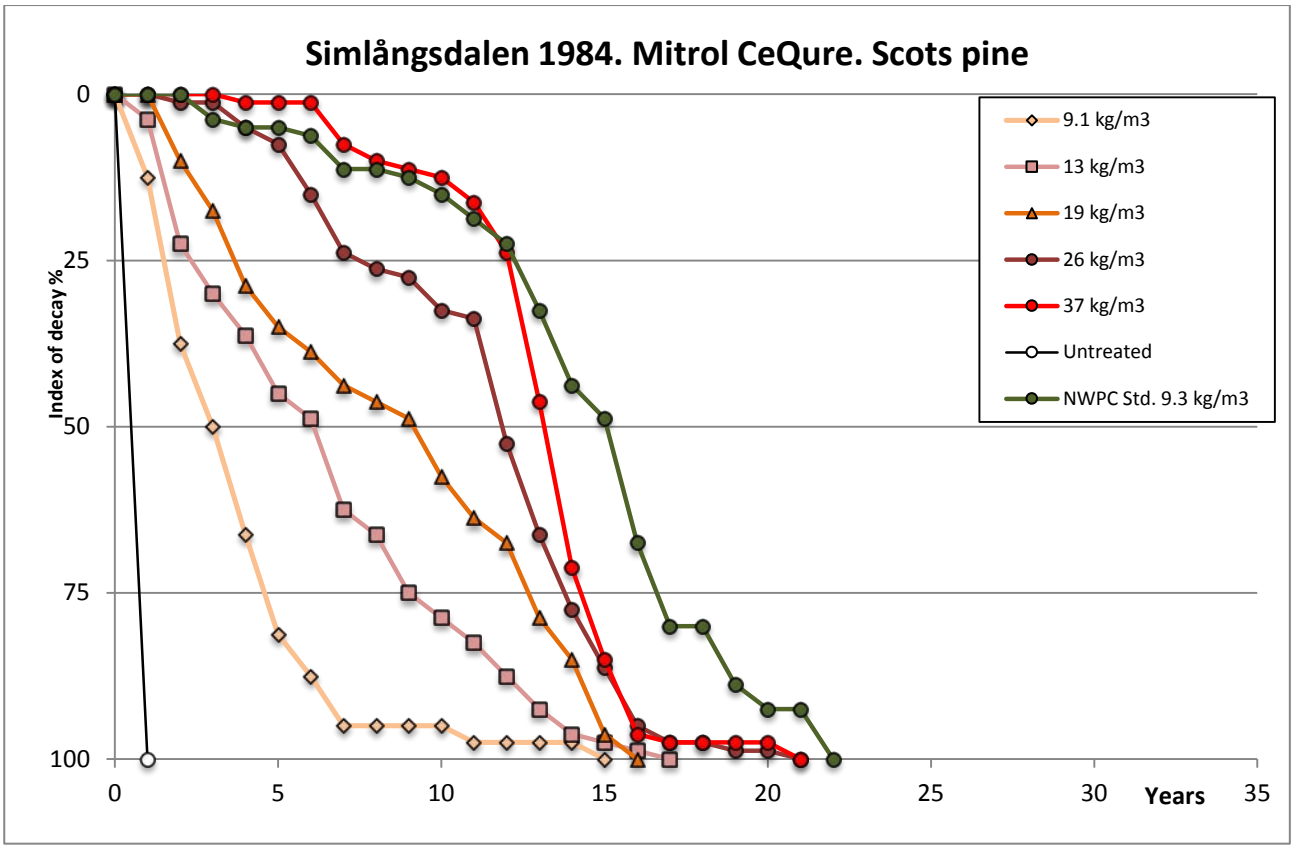


Figure 98. Field trial 1984. Index of decay for stakes of Scots pine treated with Celcure A oxide.



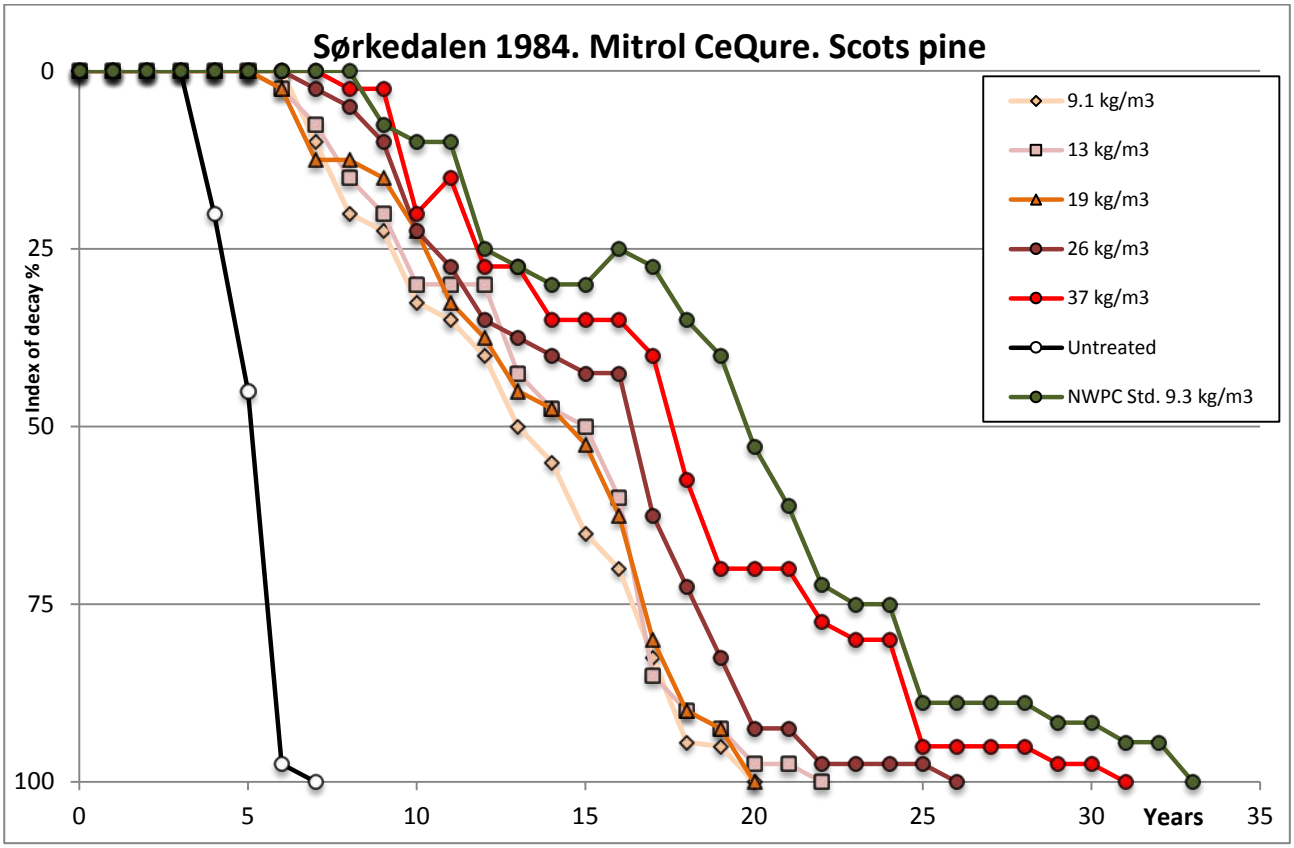
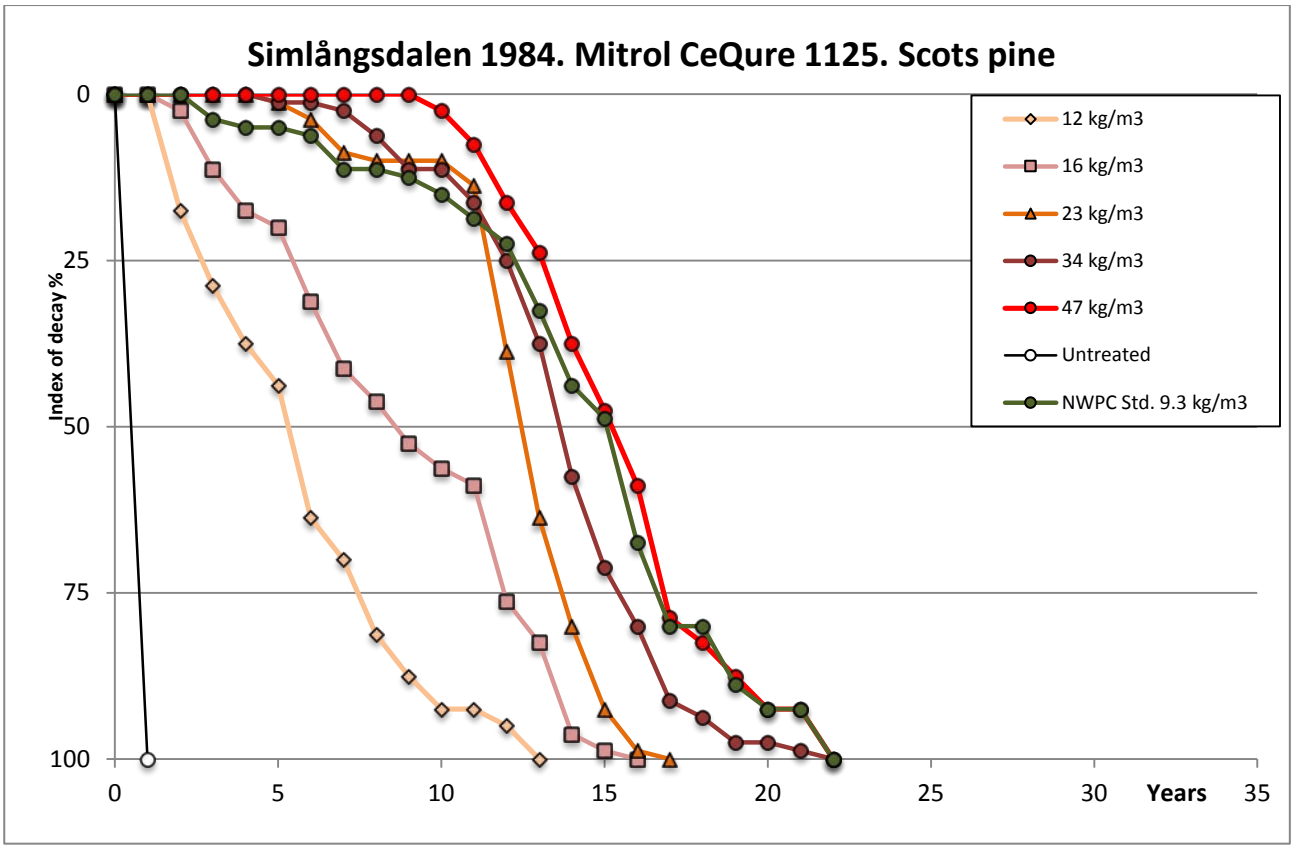


Figure 99. Field trial 1984. Index of decay for stakes of Scots pine treated with Mitrol CeQure.



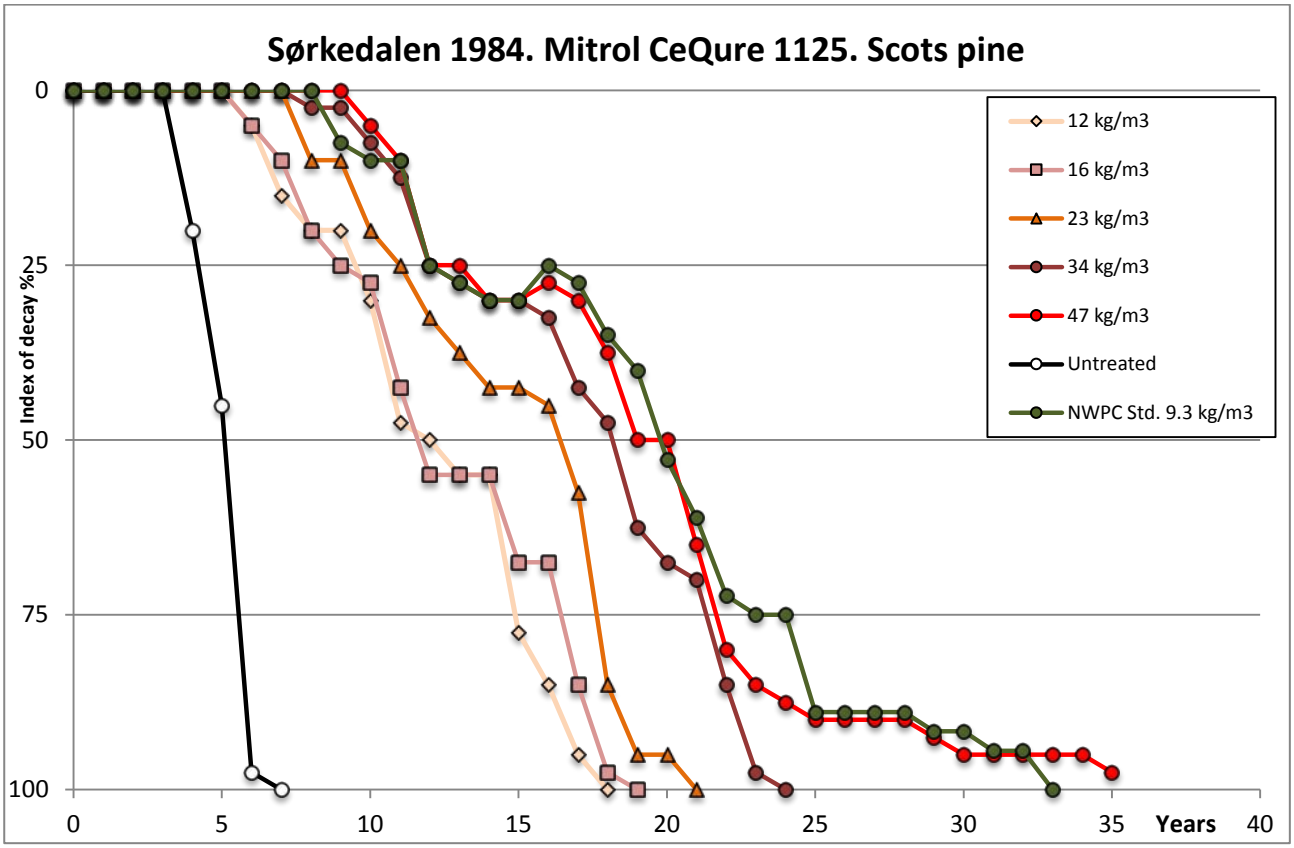
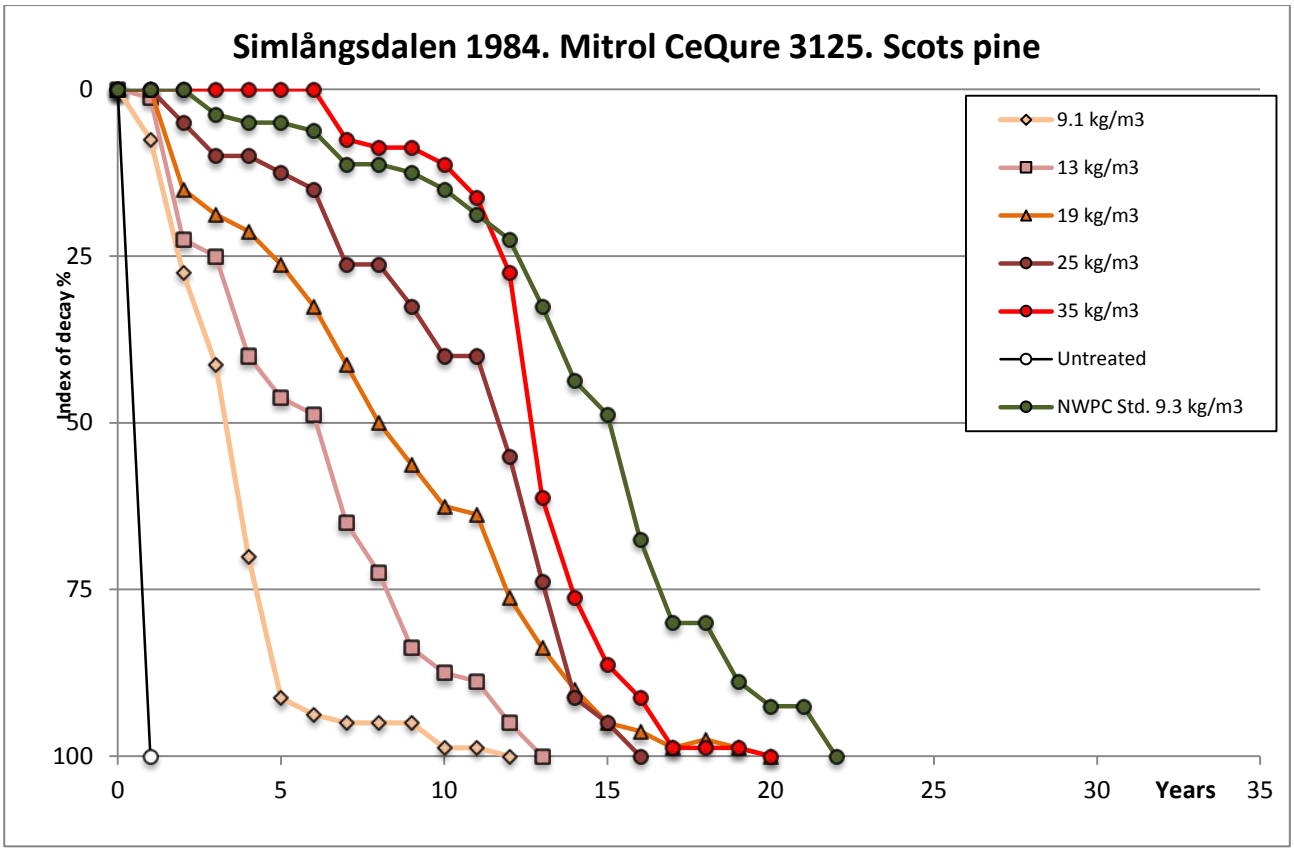


Figure 100. Field trial 1984. Index of decay for stakes of Scots pine treated with Mitrol CeQure 1125.



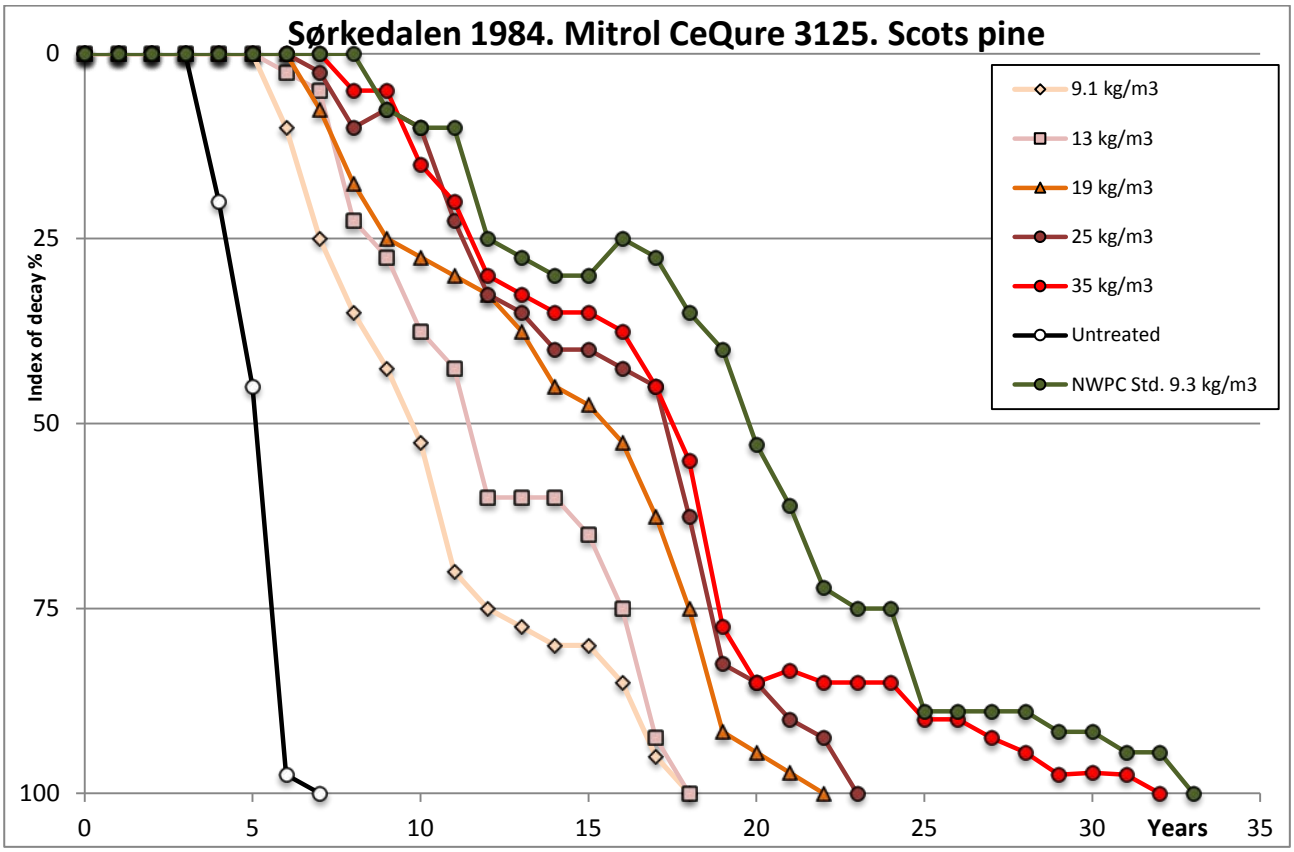
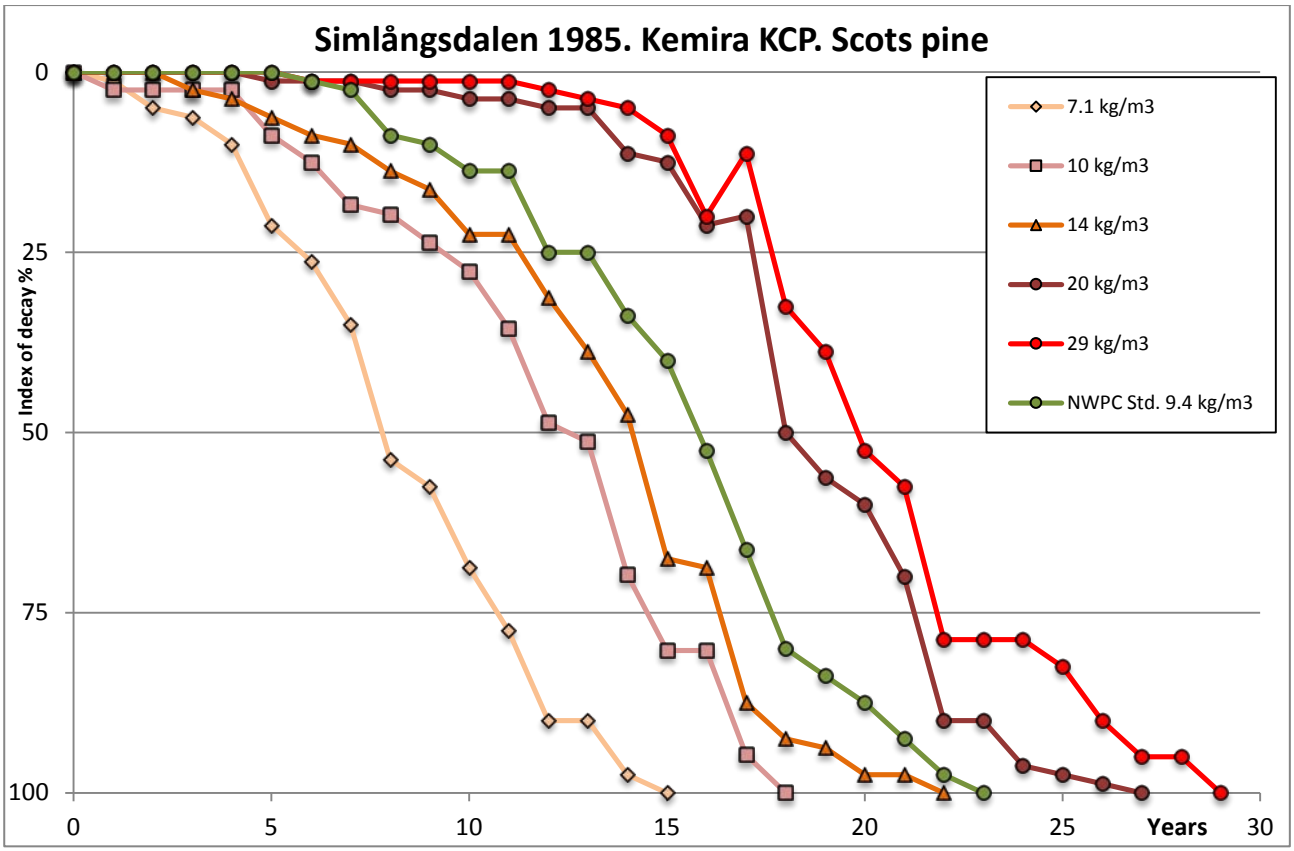


Figure 101. Field trial 1984. Index of decay for stakes of Scots pine treated with Mitrol CeQure 3125.



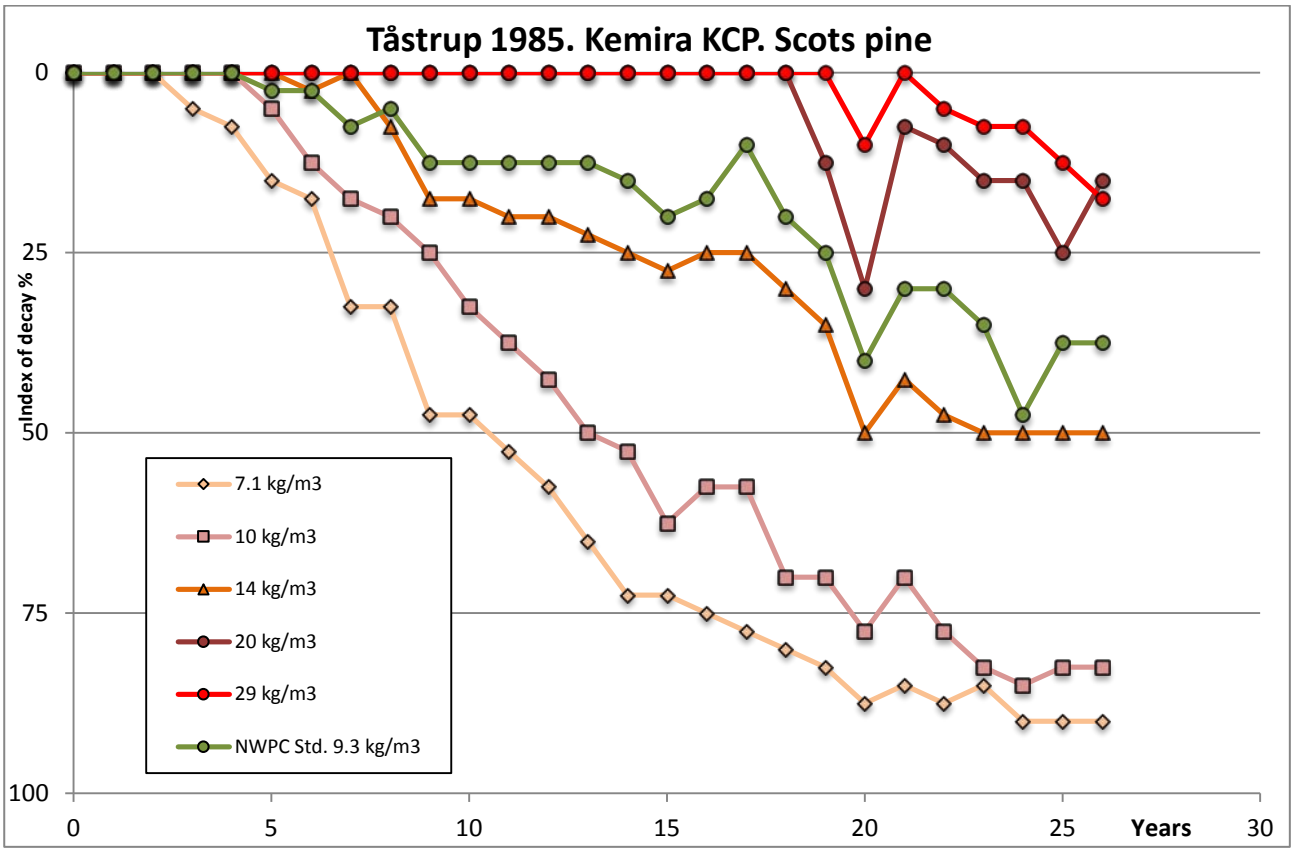
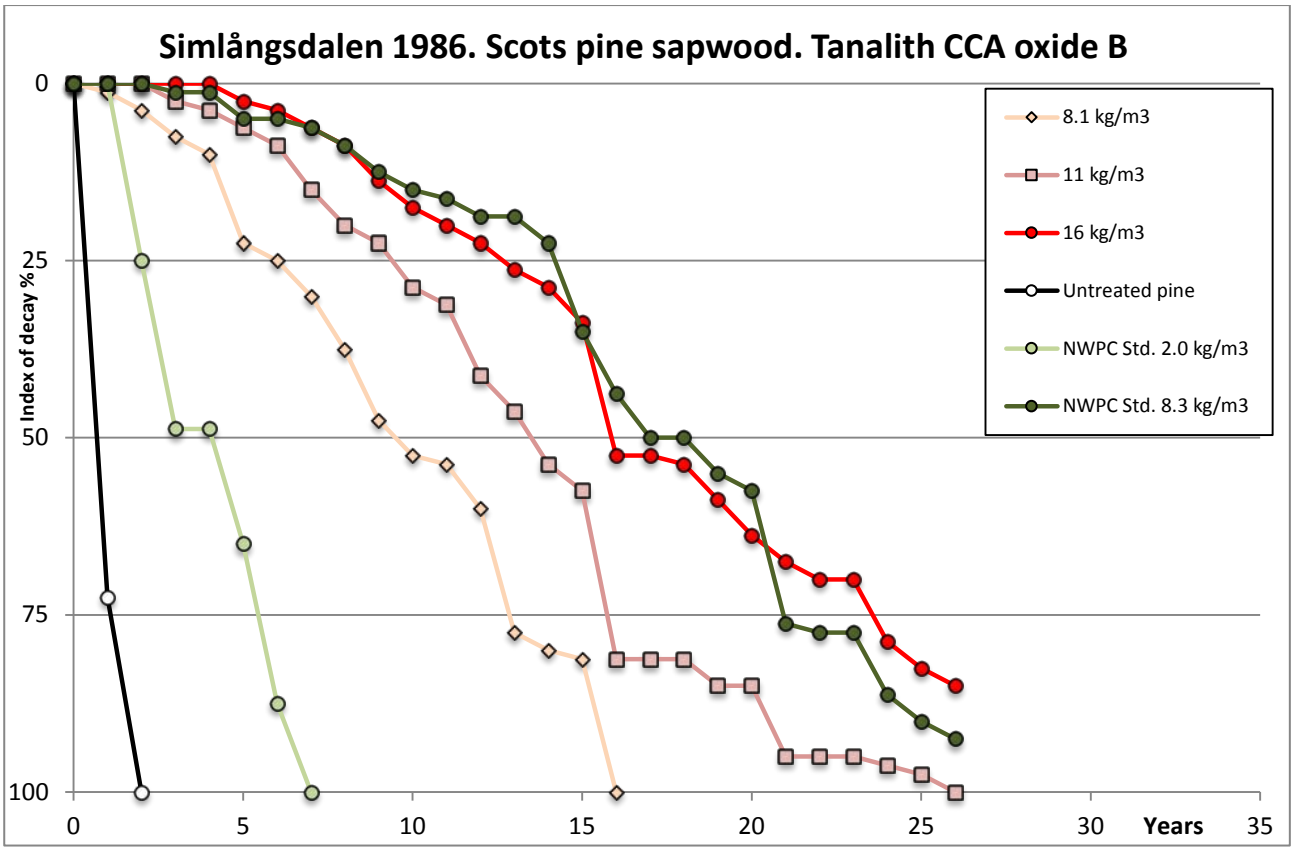


Figure 102. Field trial 1985. Index of decay for stakes of Scots pine treated with Kemira KCP.



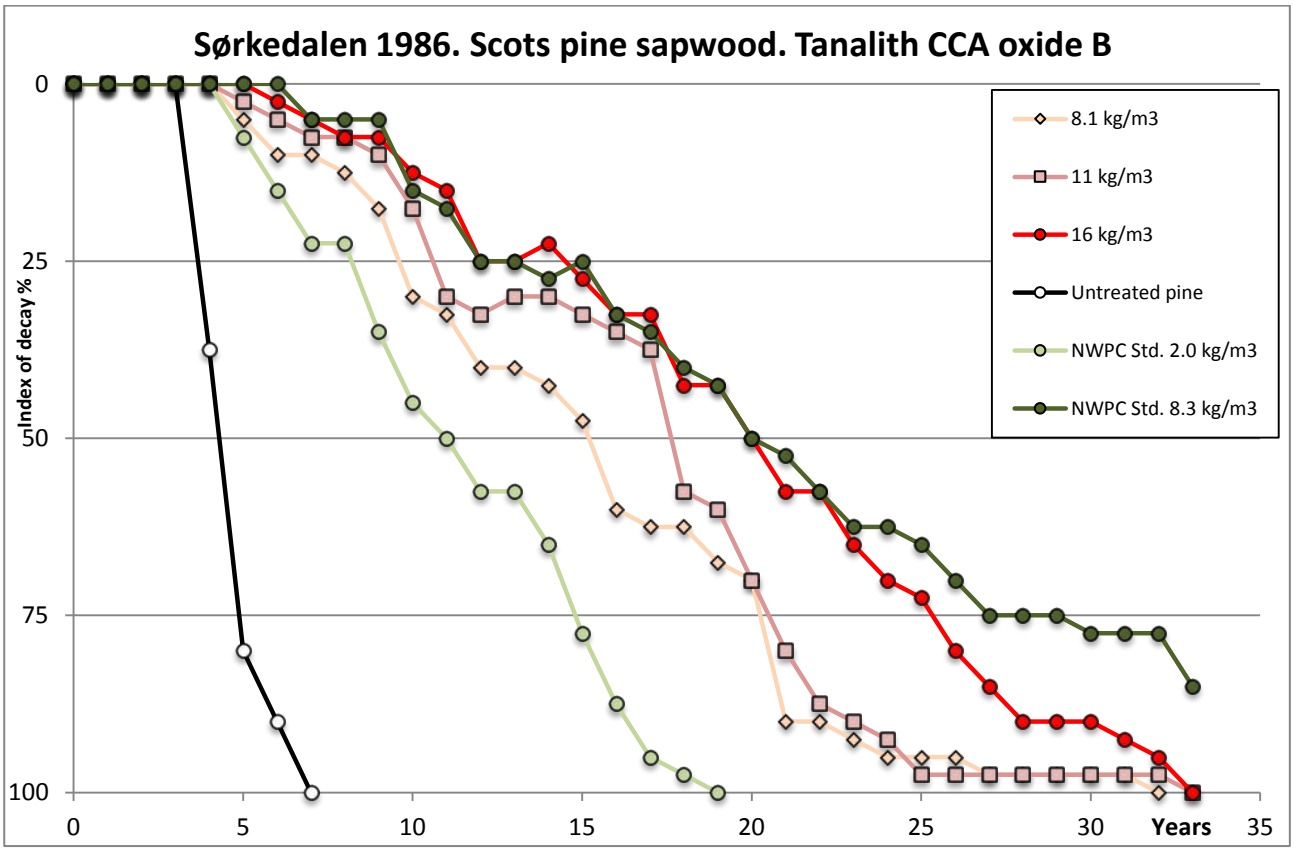
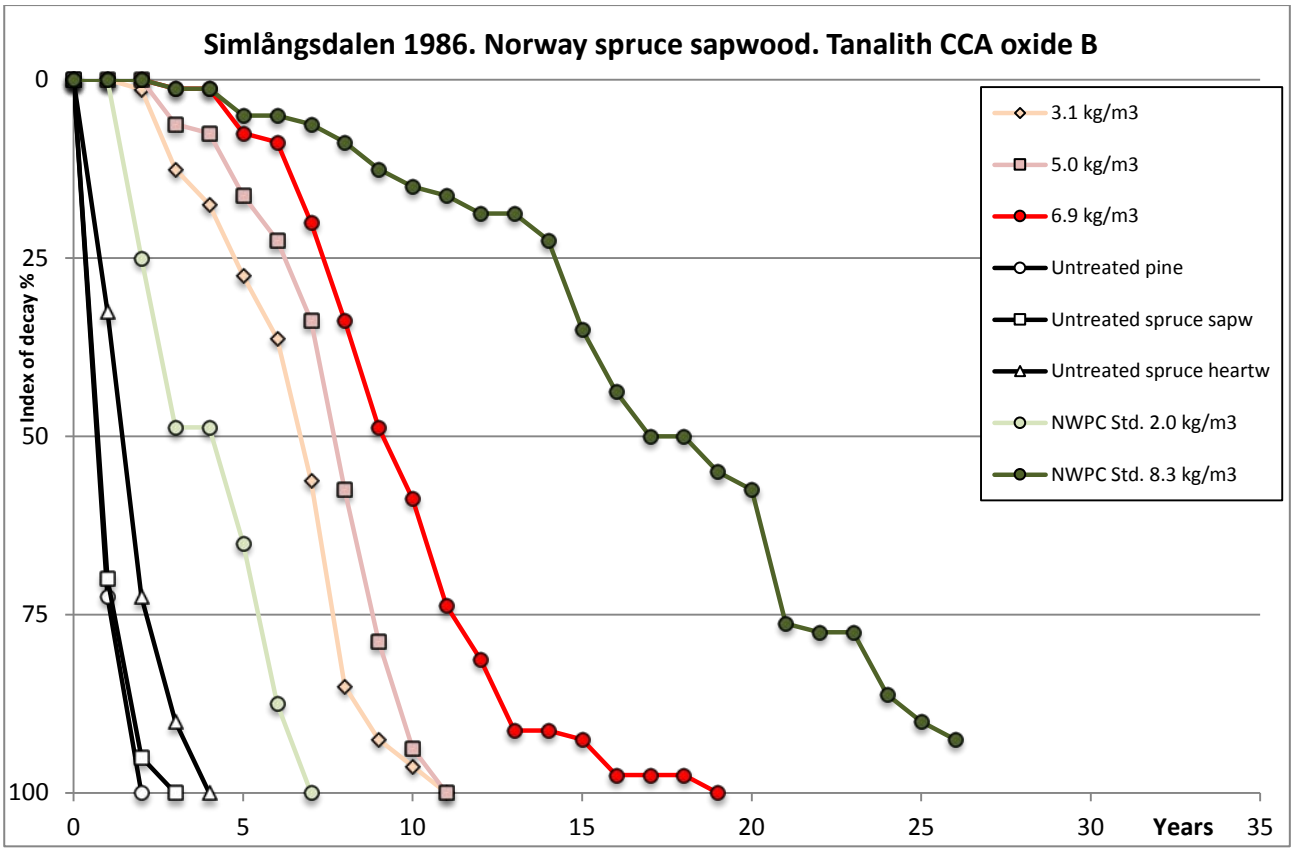


Figure 103. Field trial 1986. Index of decay for stakes of Scots pine sapwood treated with Tanalith CCA oxide B.



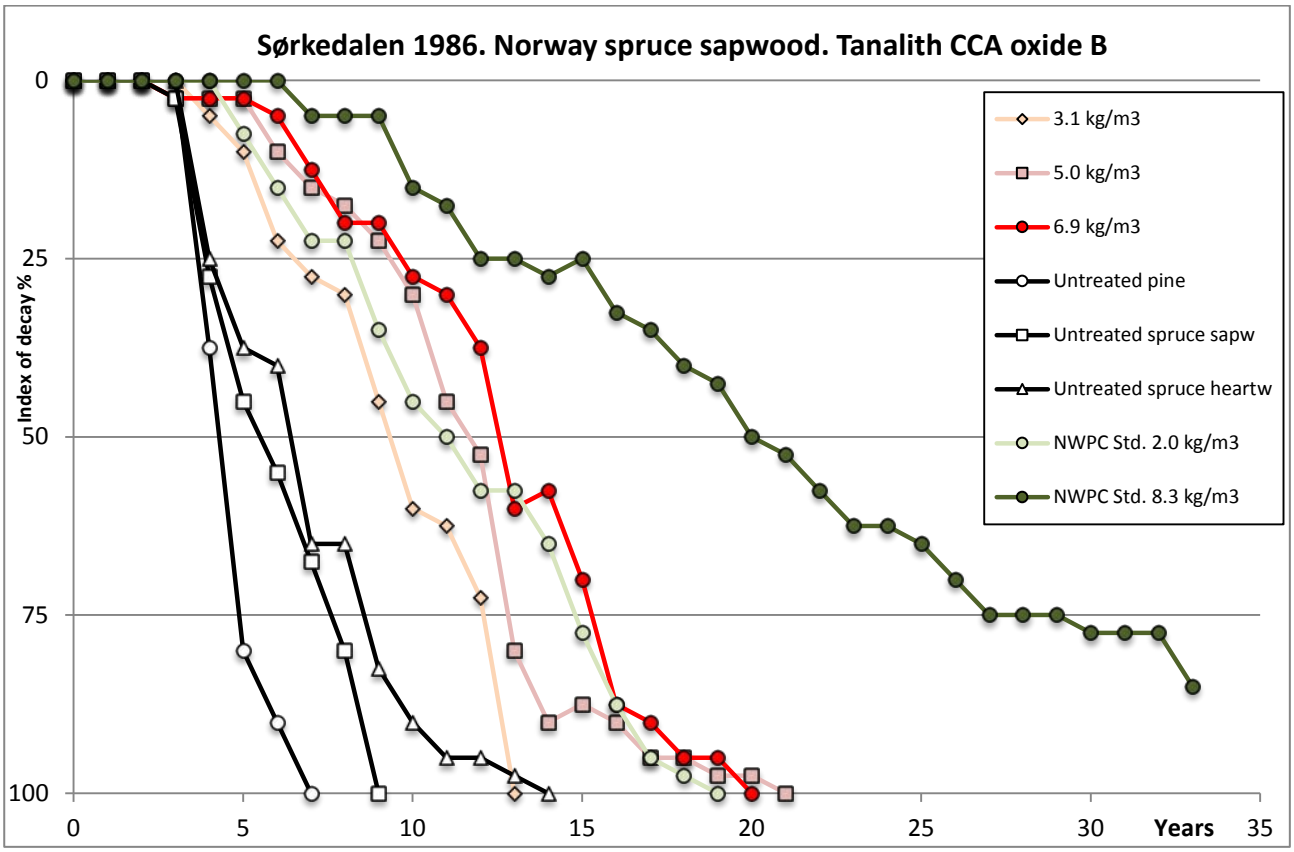
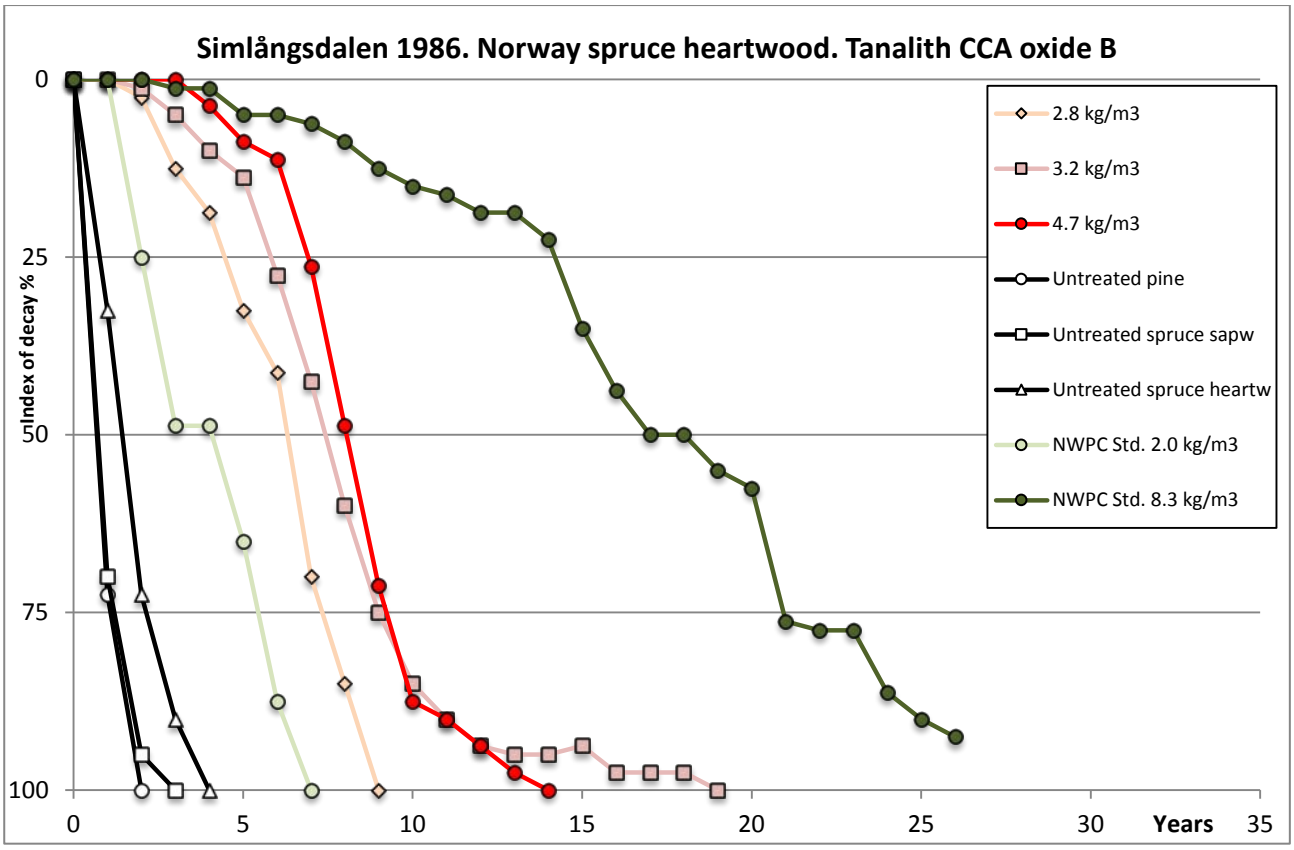


Figure 104. Field trial 1986. Index of decay for stakes of Norway spruce sapwood treated with Tanalith CCA oxide B.



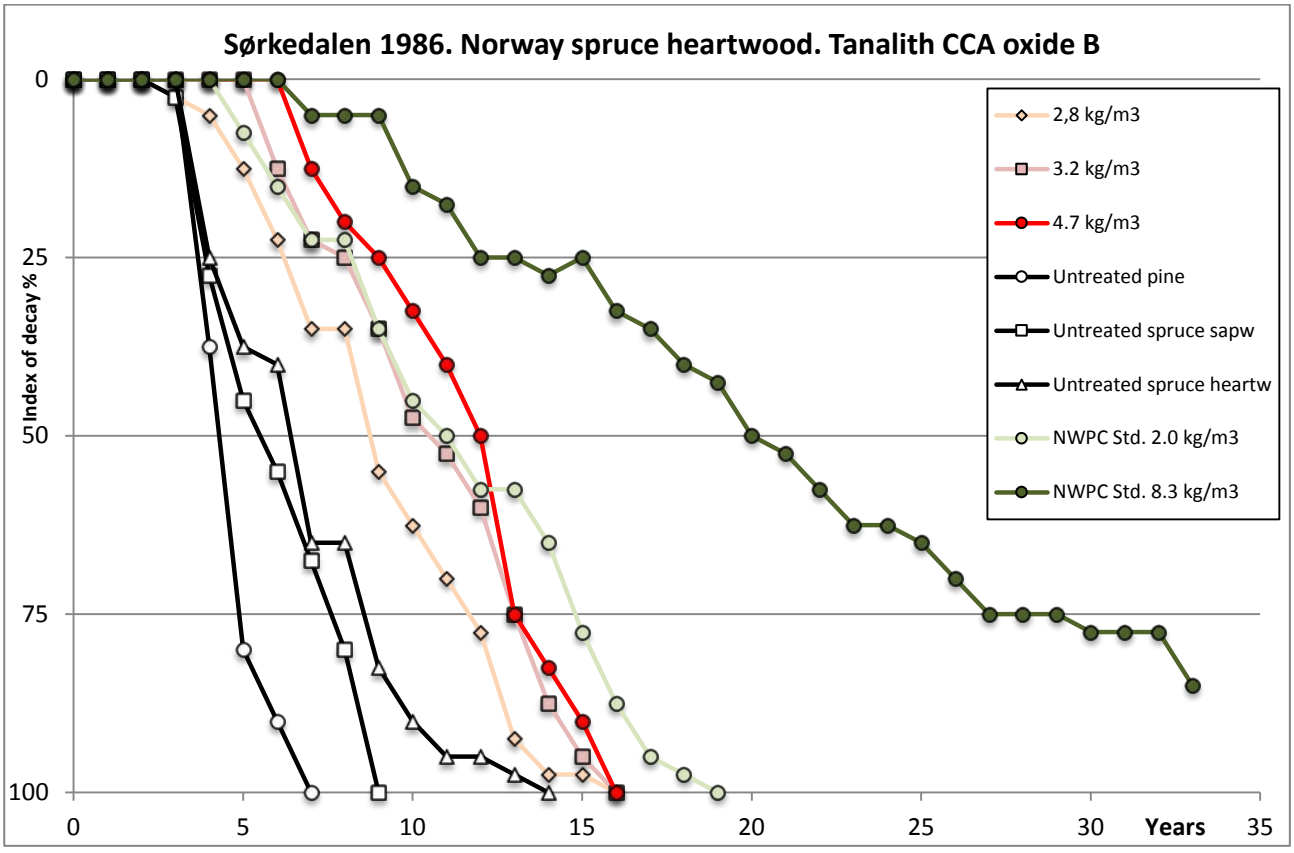
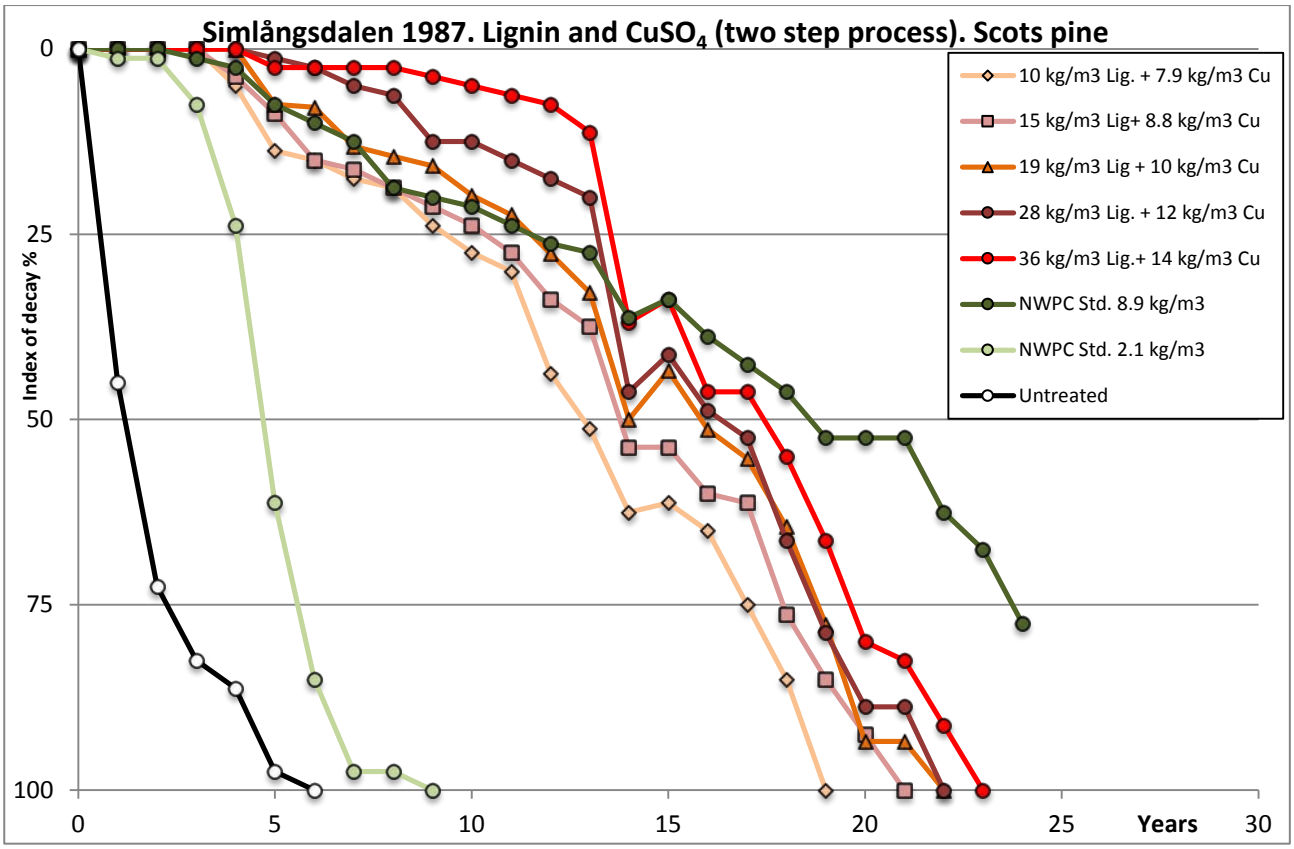


Figure 105. Field trial 1986. Index of decay for stakes of Norway spruce heartwood treated with Tanalith CCA oxide B.



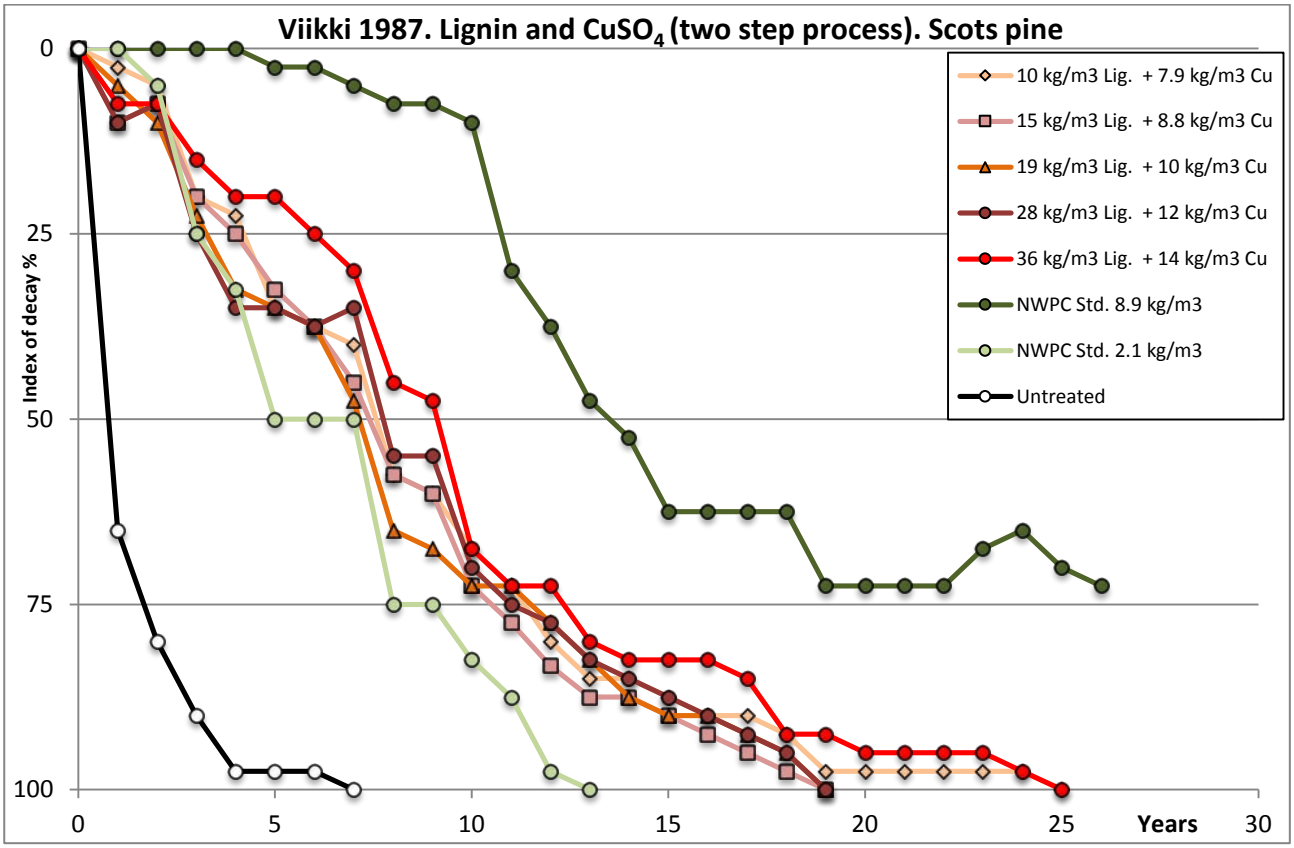
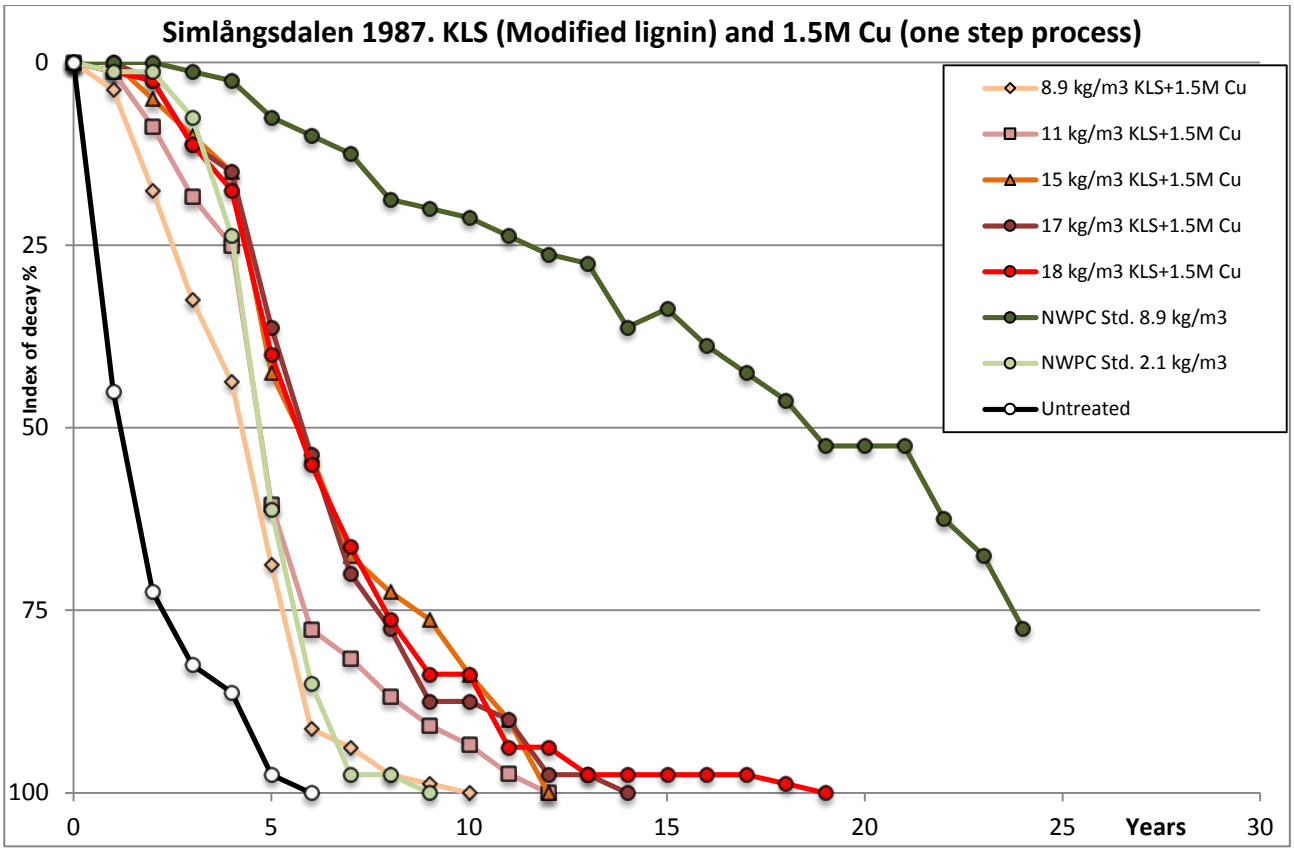


Figure 106. Field trial 1987. Index of decay for stakes of Scots pine treated with modified lignin and $CuSO_4$ with a two step process.



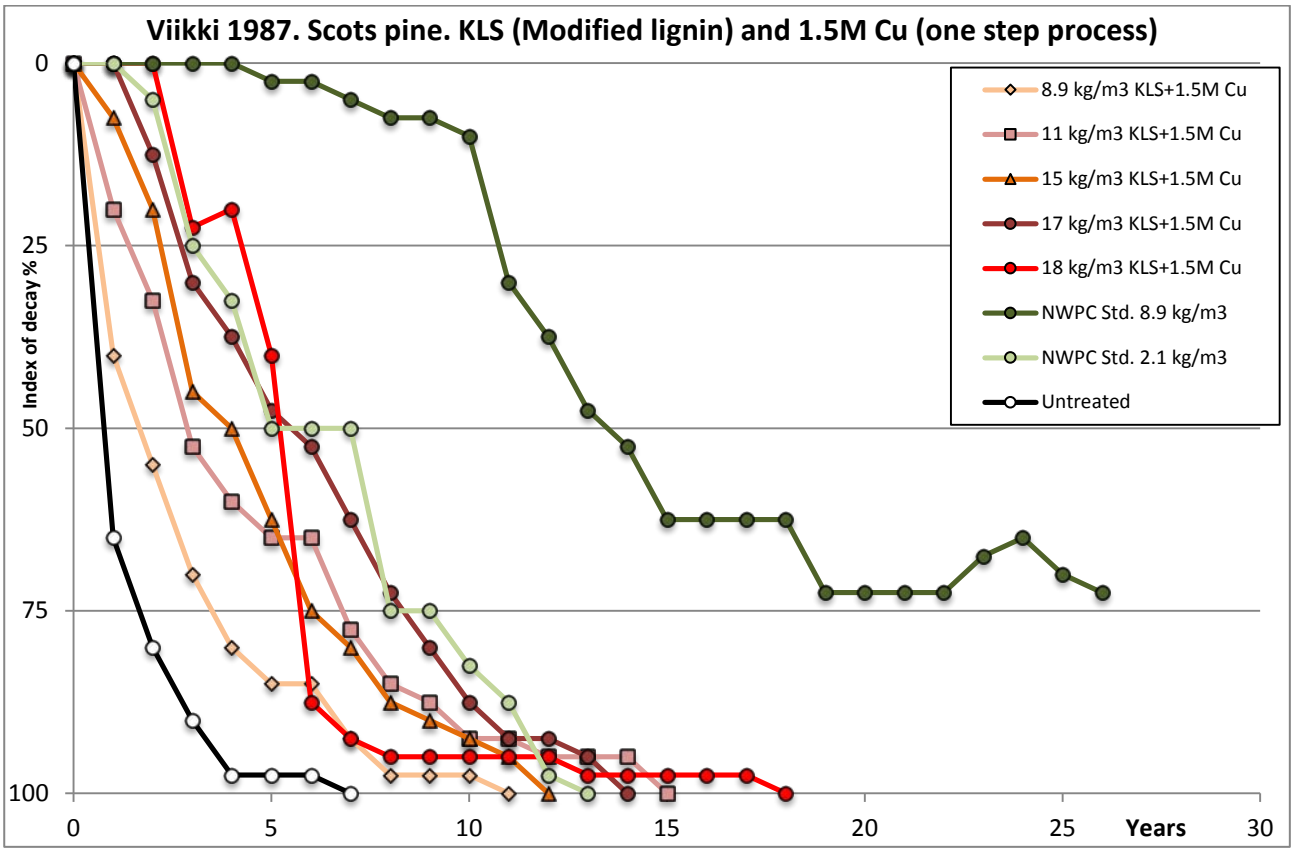
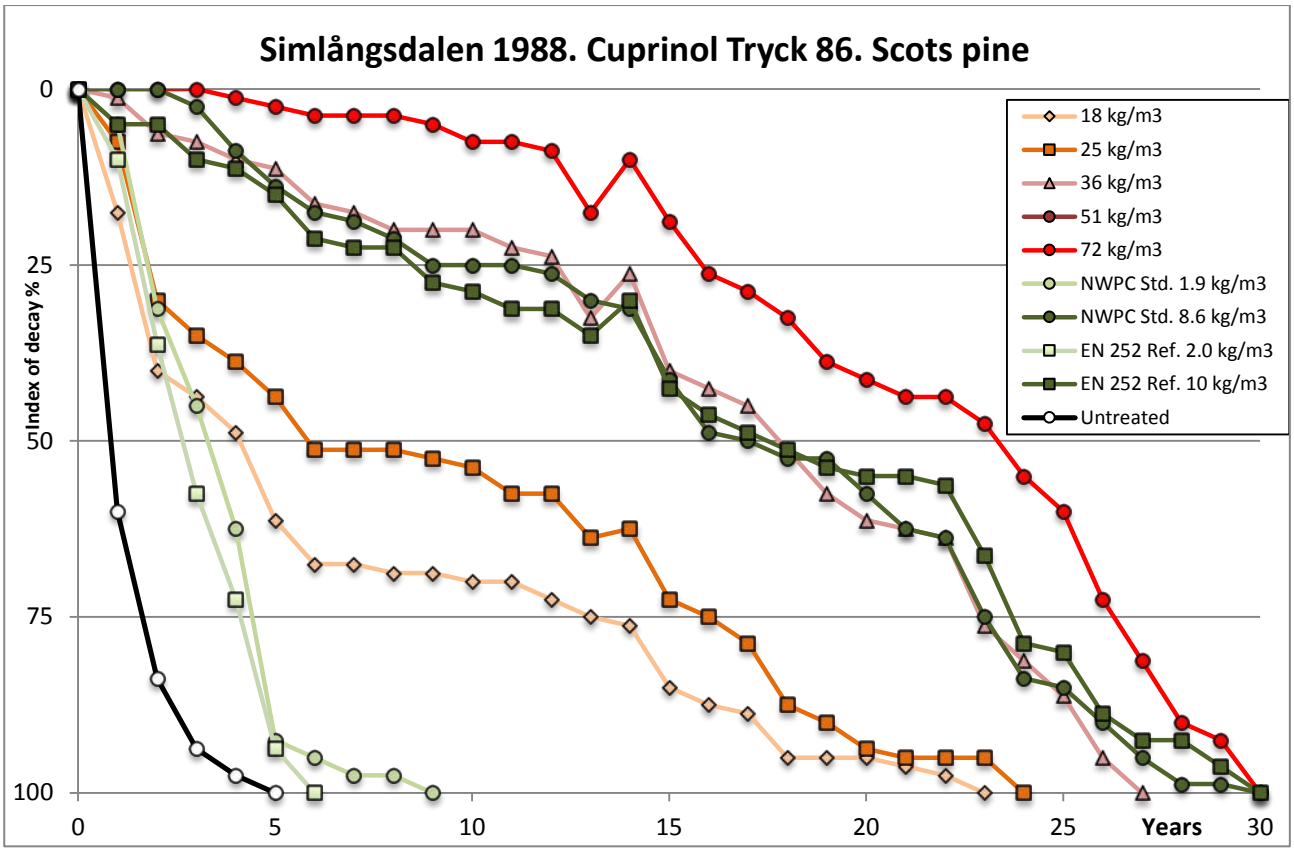


Figure 107. Field trial 1987. Index of decay for stakes of Scots pine treated with modified lignin and $CuSO_4$ with a one step process.



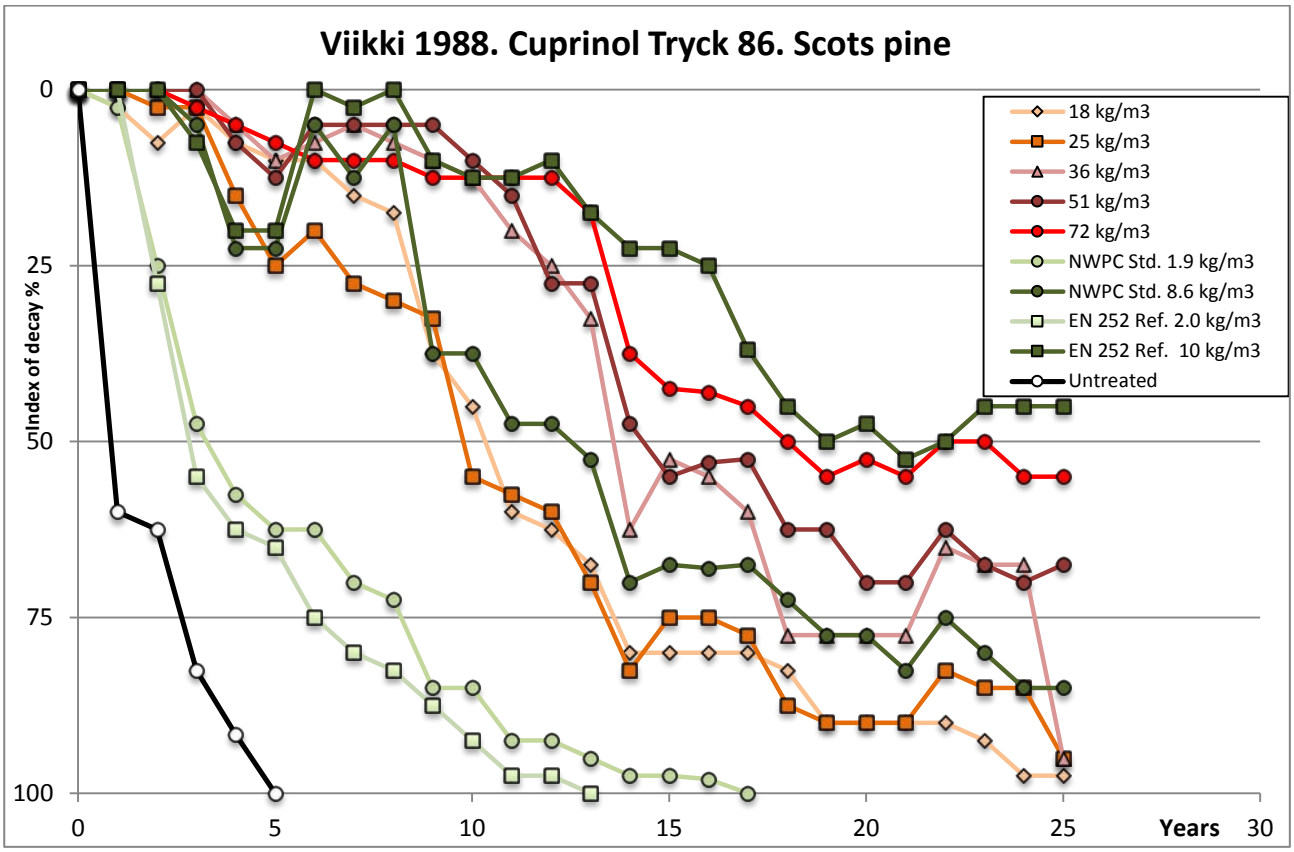
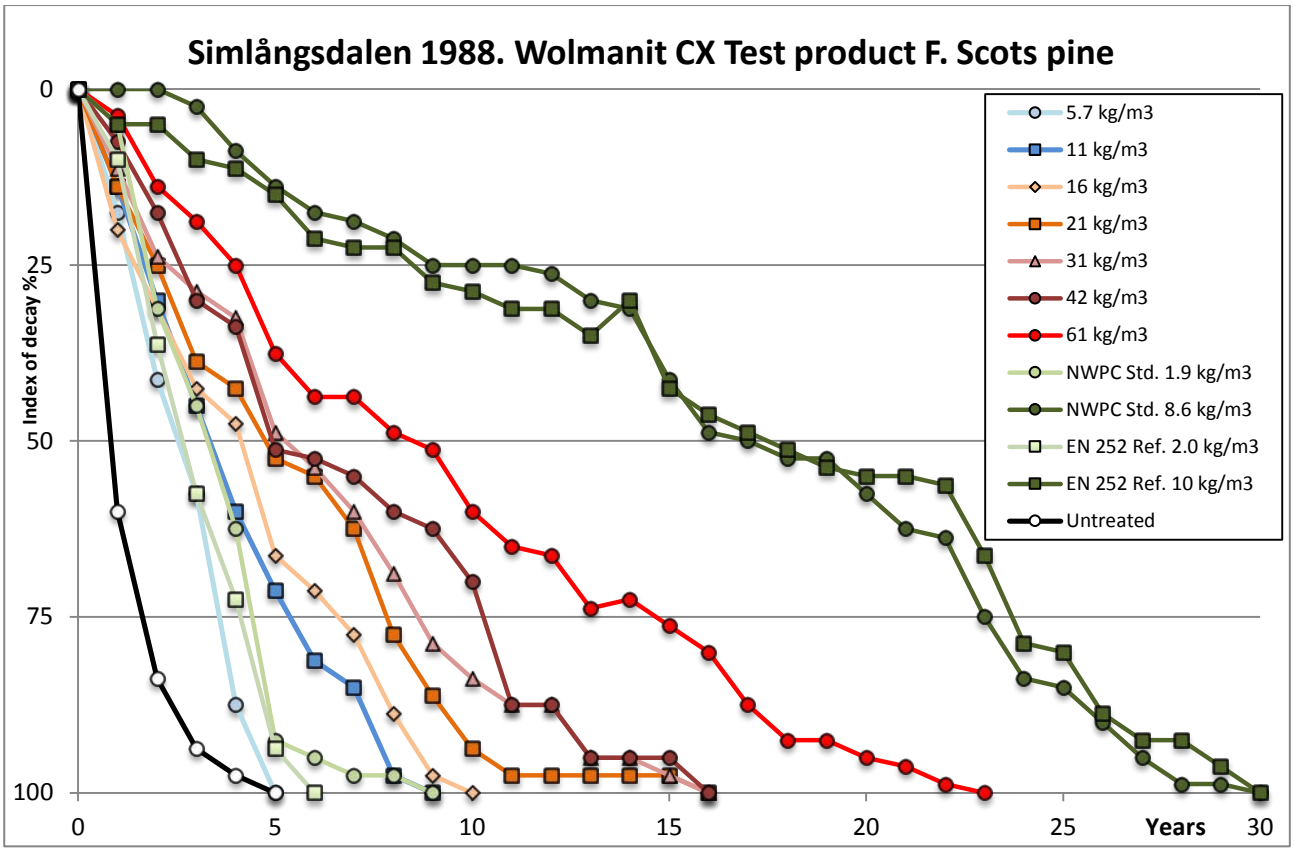


Figure 108. Field trial 1988. Index of decay for stakes of Scots pine treated with Cuprinol Tryck 86.



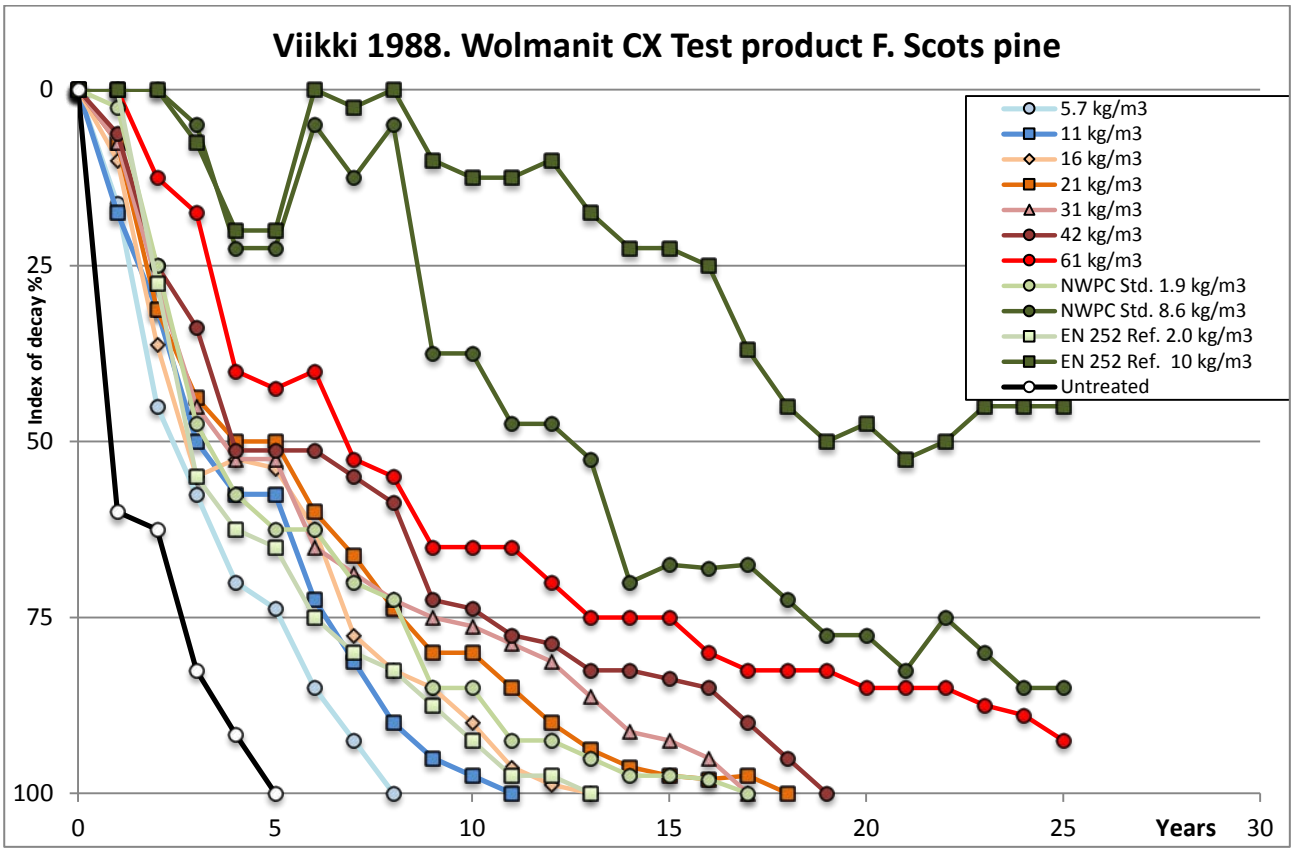
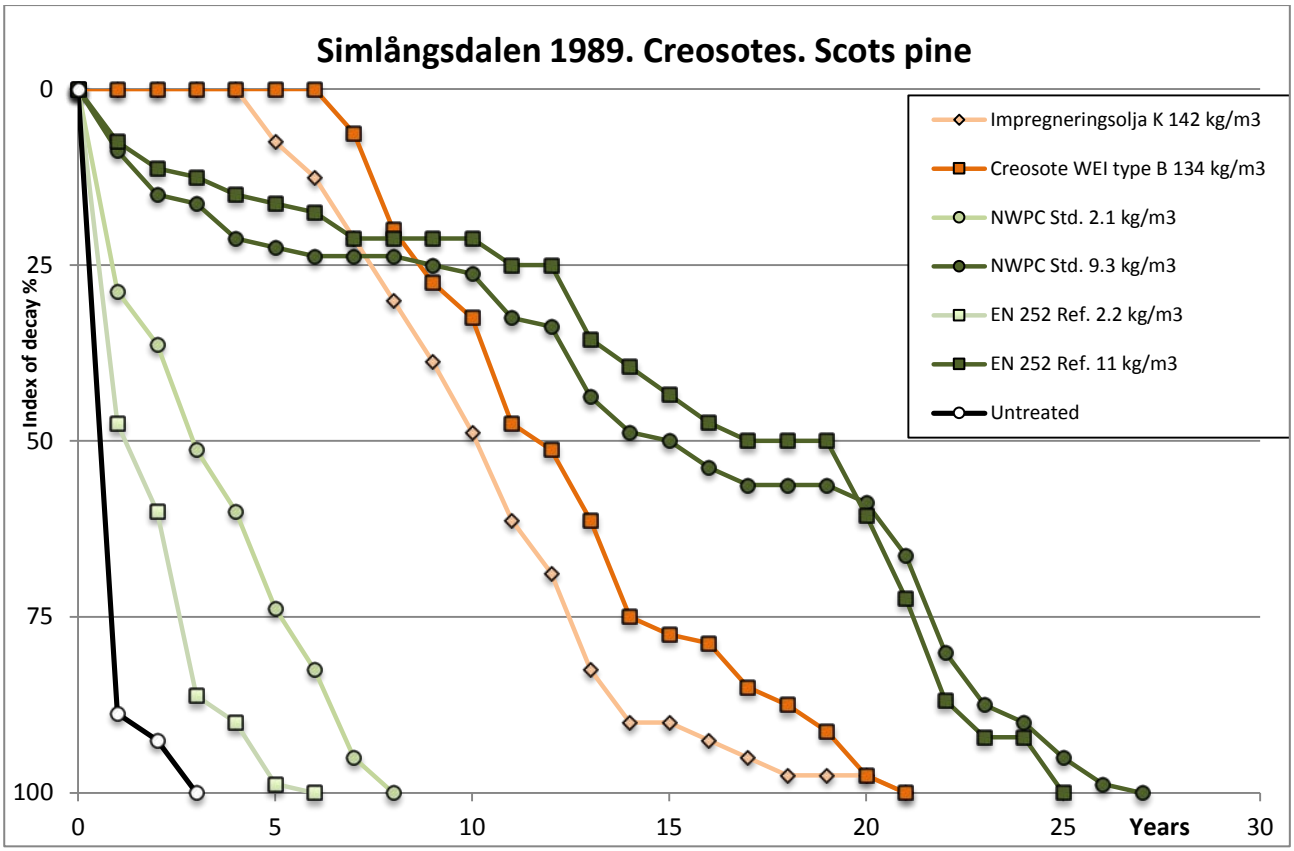


Figure 109. Field trial 1988. Index of decay for stakes of Scots pine treated with Wolmanit CX Test product F.



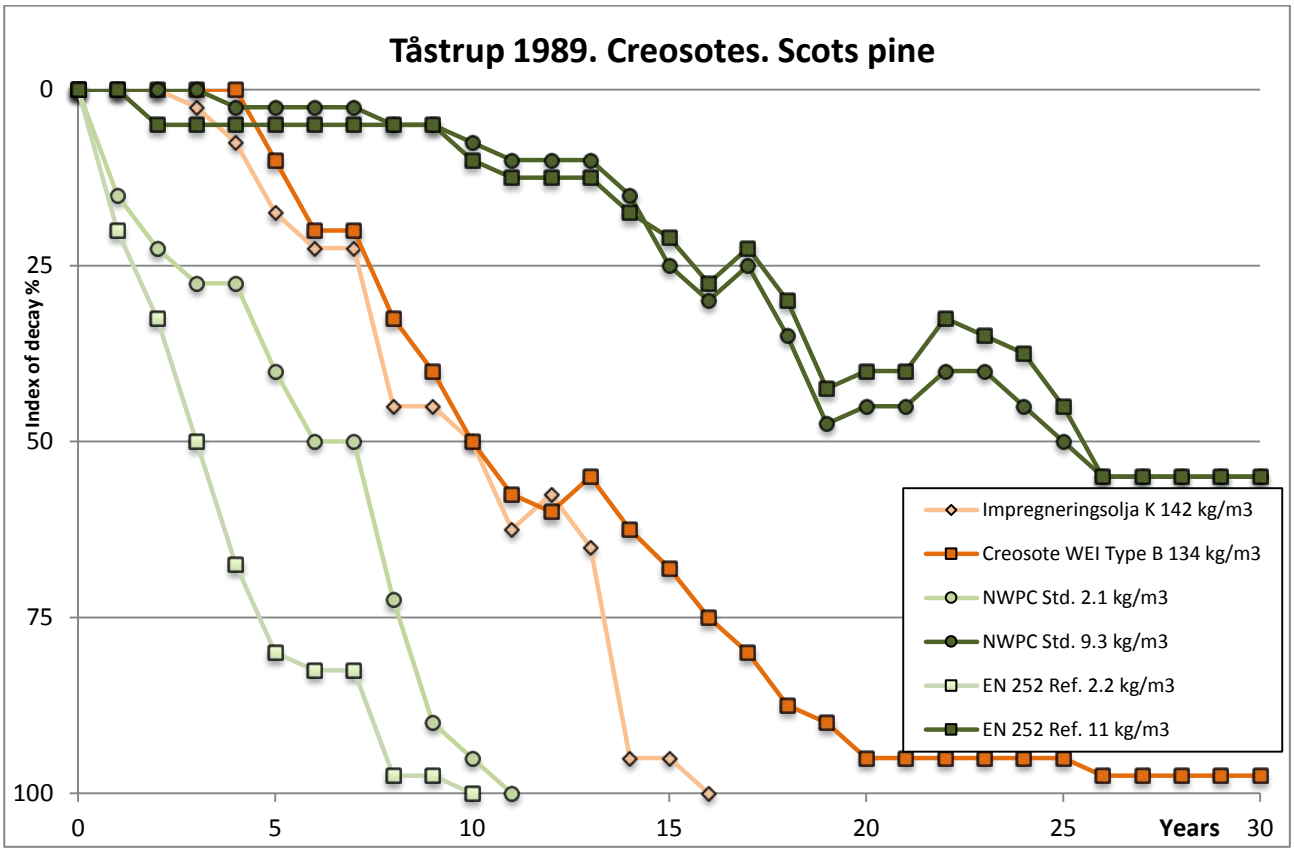
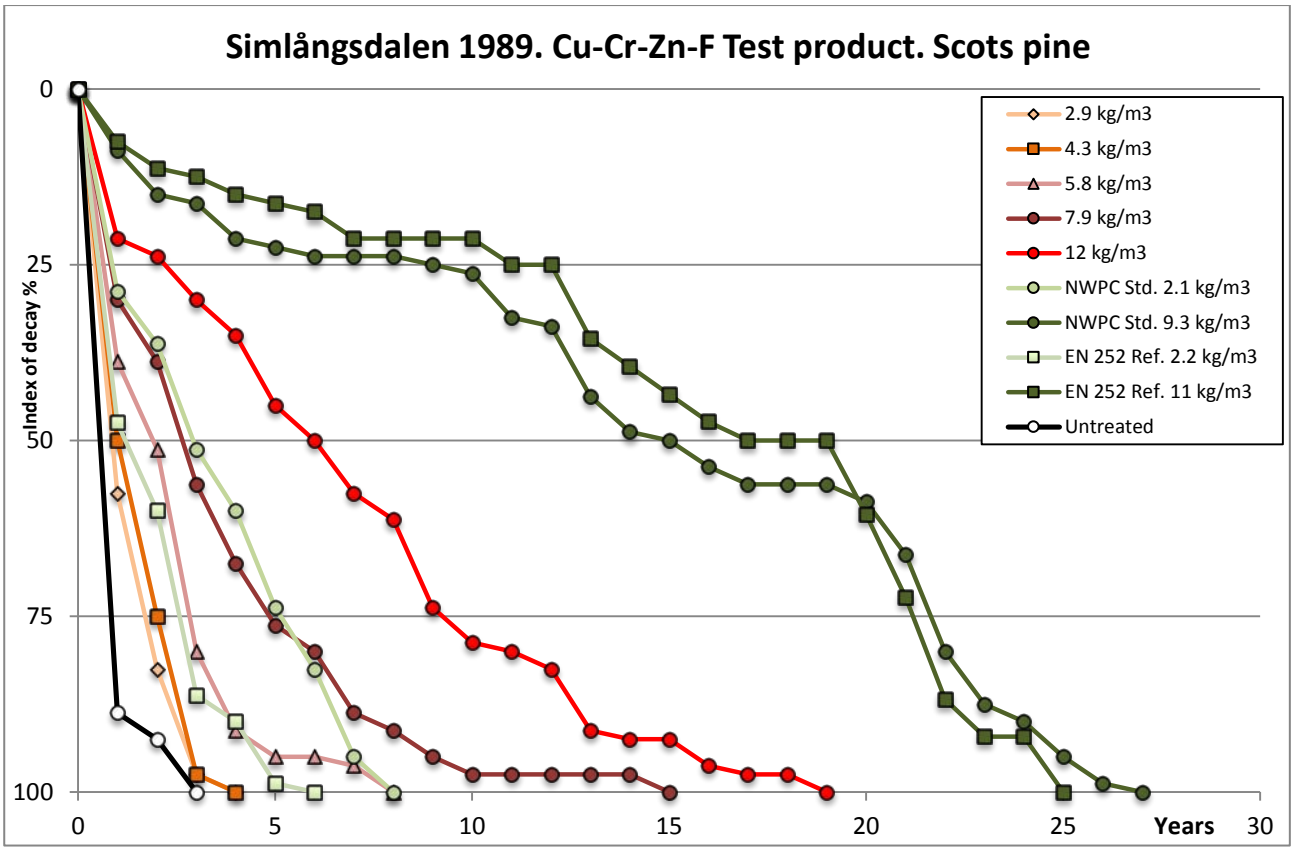


Figure 110. Field trial 1989. Index of decay for stakes of Scots pine treated with two Creosote products.



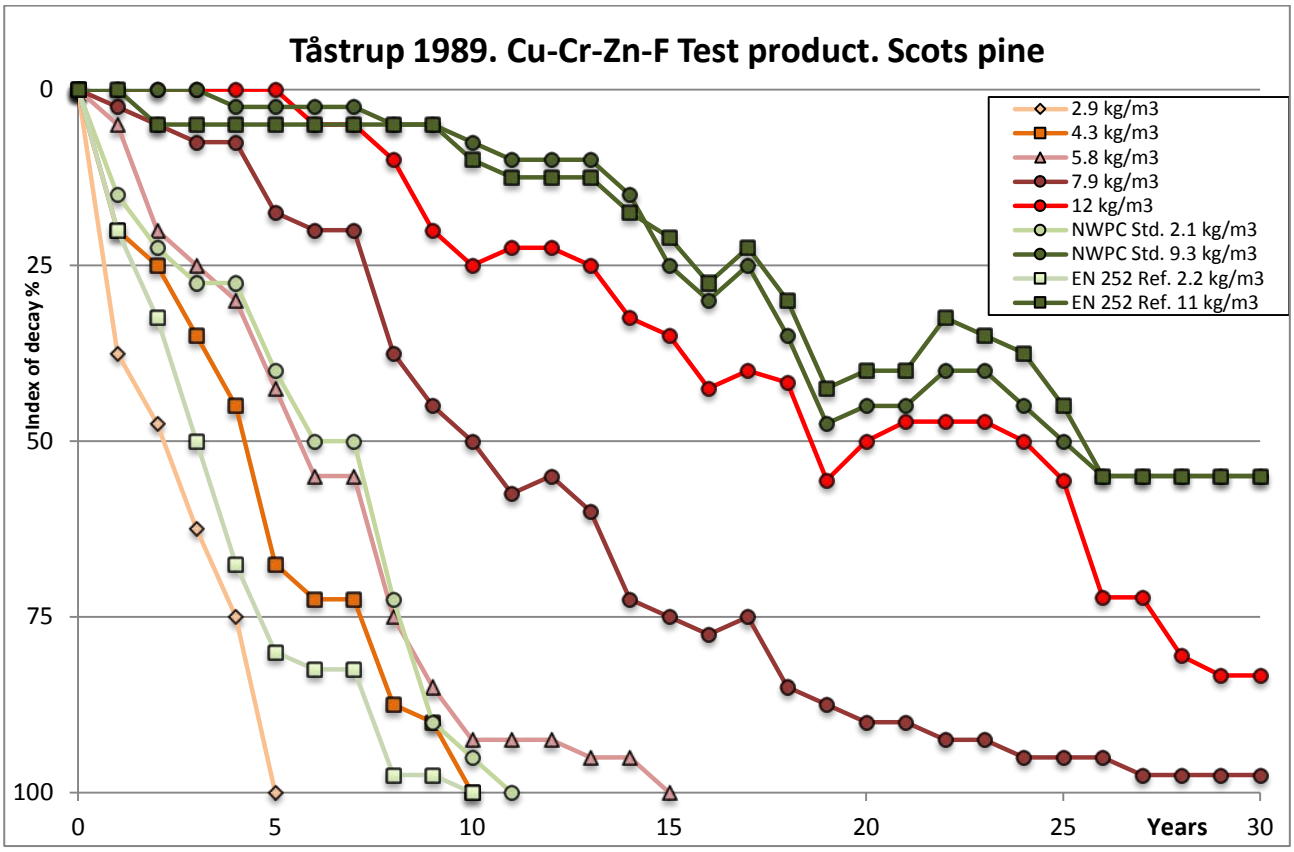
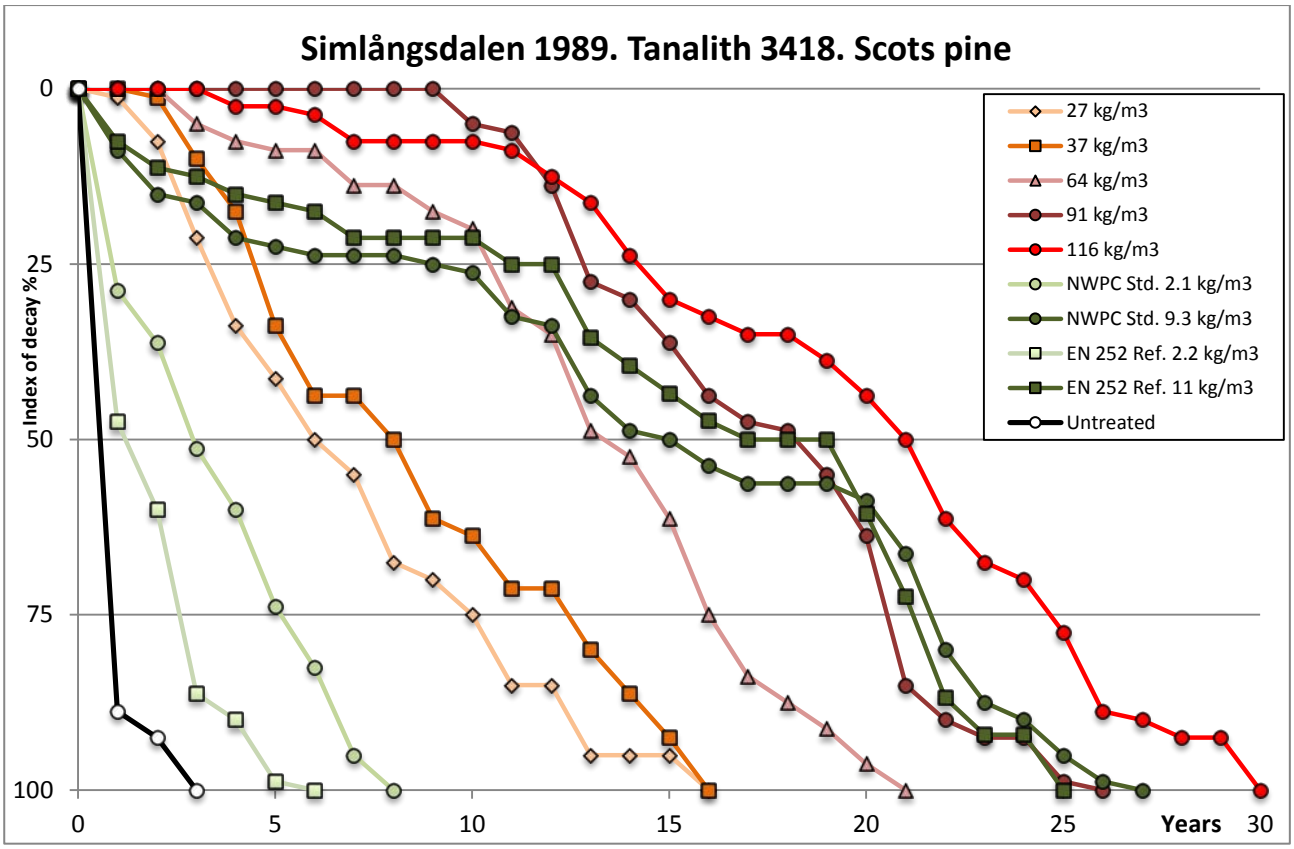


Figure 111. Field trial 1989. Index of decay for stakes of Scots pine treated with Cu-Cr-Zn-F Test product.



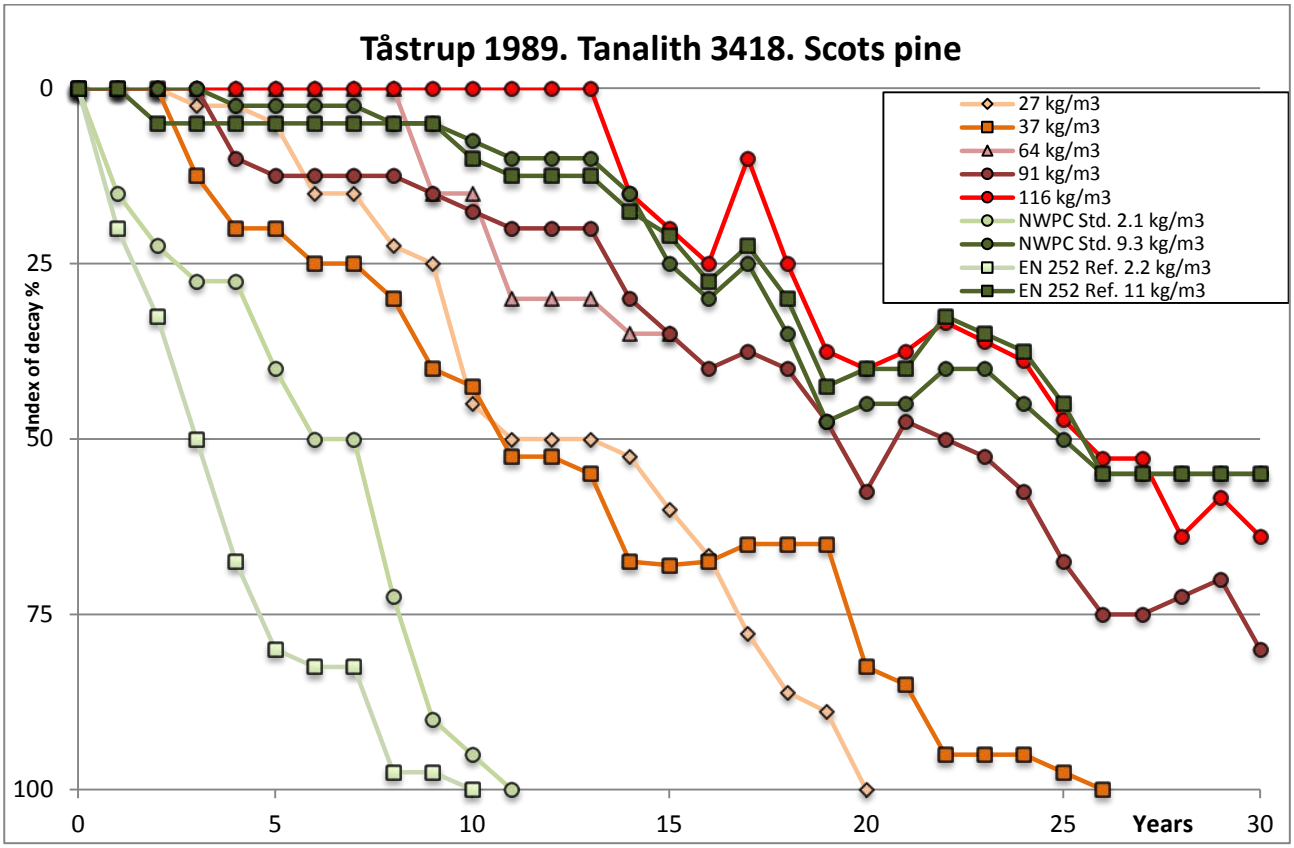
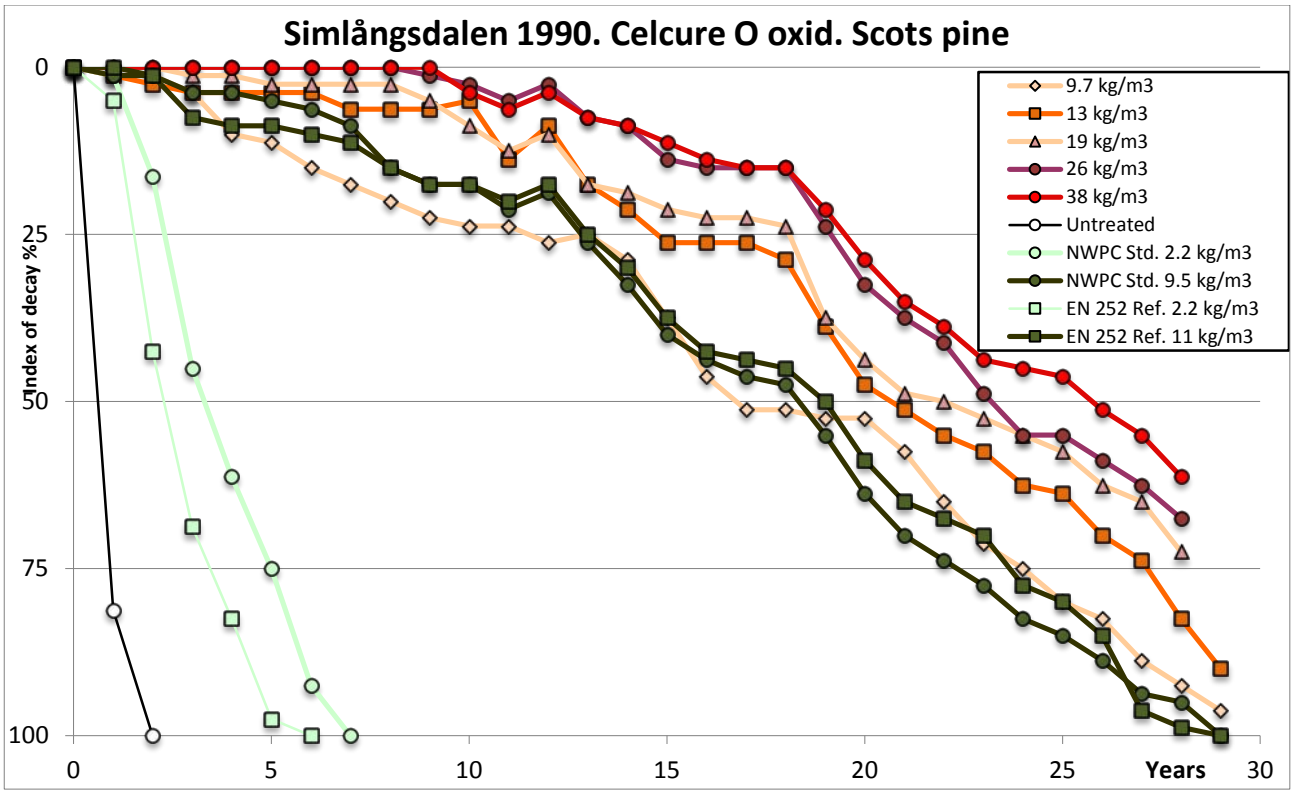


Figure 112. Field trial 1989. Index of decay for stakes of Scots pine treated with Tanalith 3418.



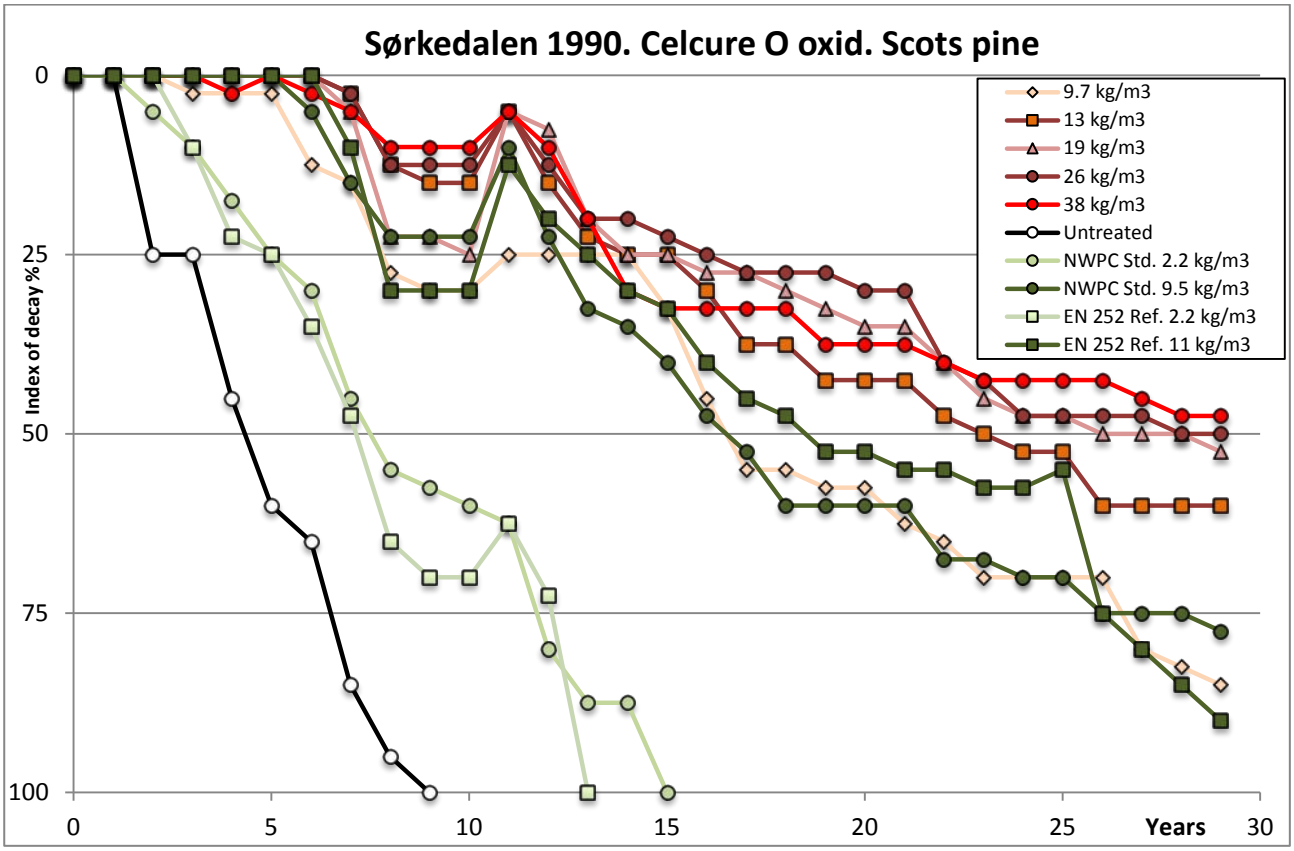
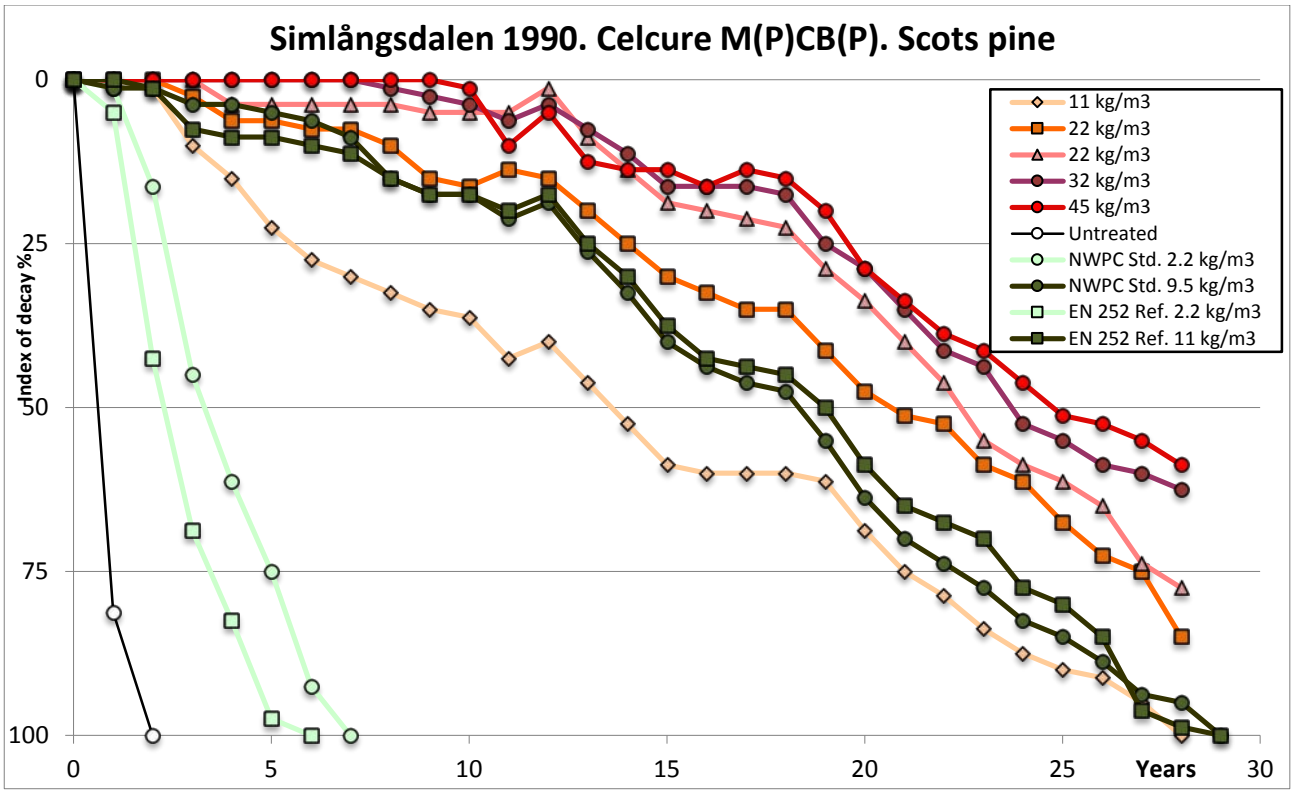


Figure 113. Field trial 1990. Index of decay for stakes of Scots pine treated with Celcure O oxid.



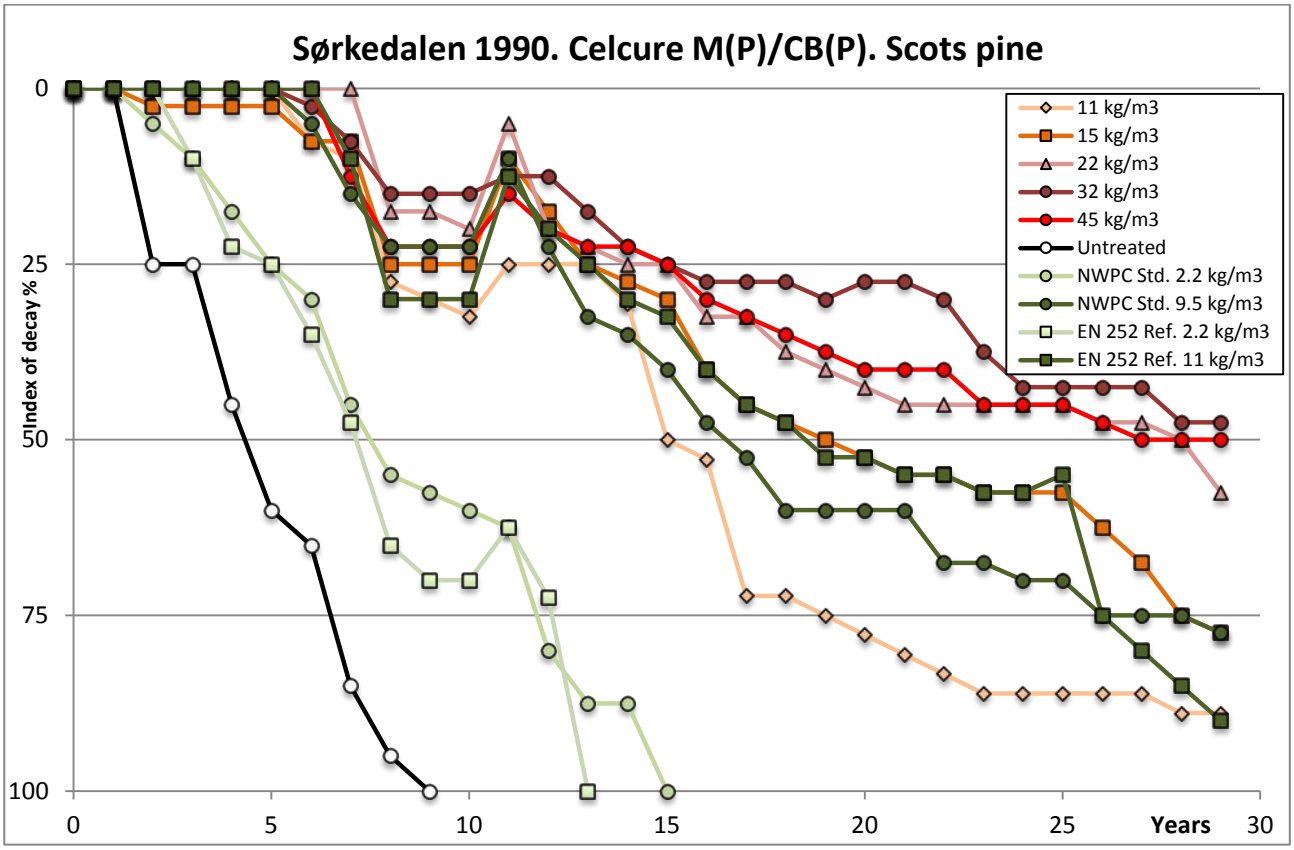
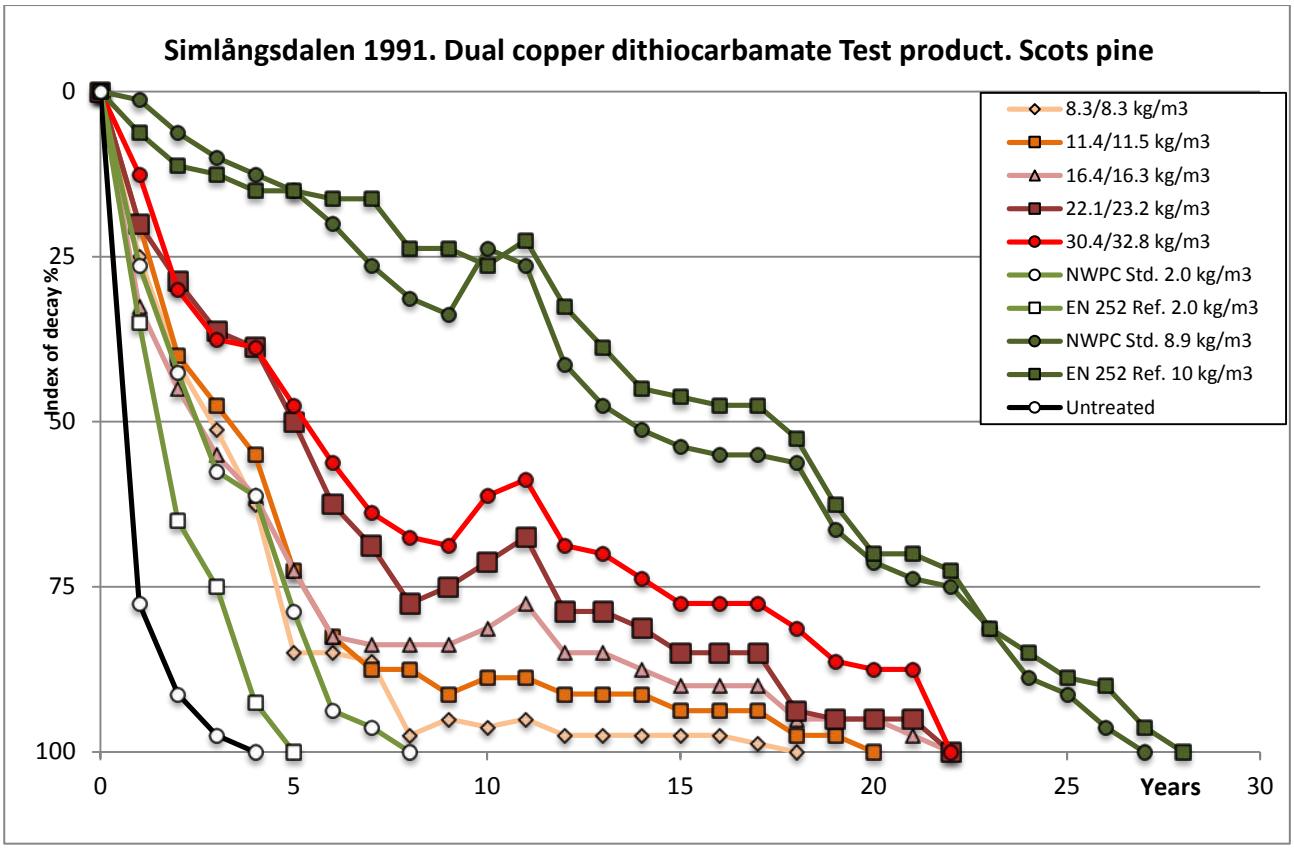


Figure 114. Field trial 1990. Index of decay for stakes of Scots pine treated with Celcure M(P)/CB(P).



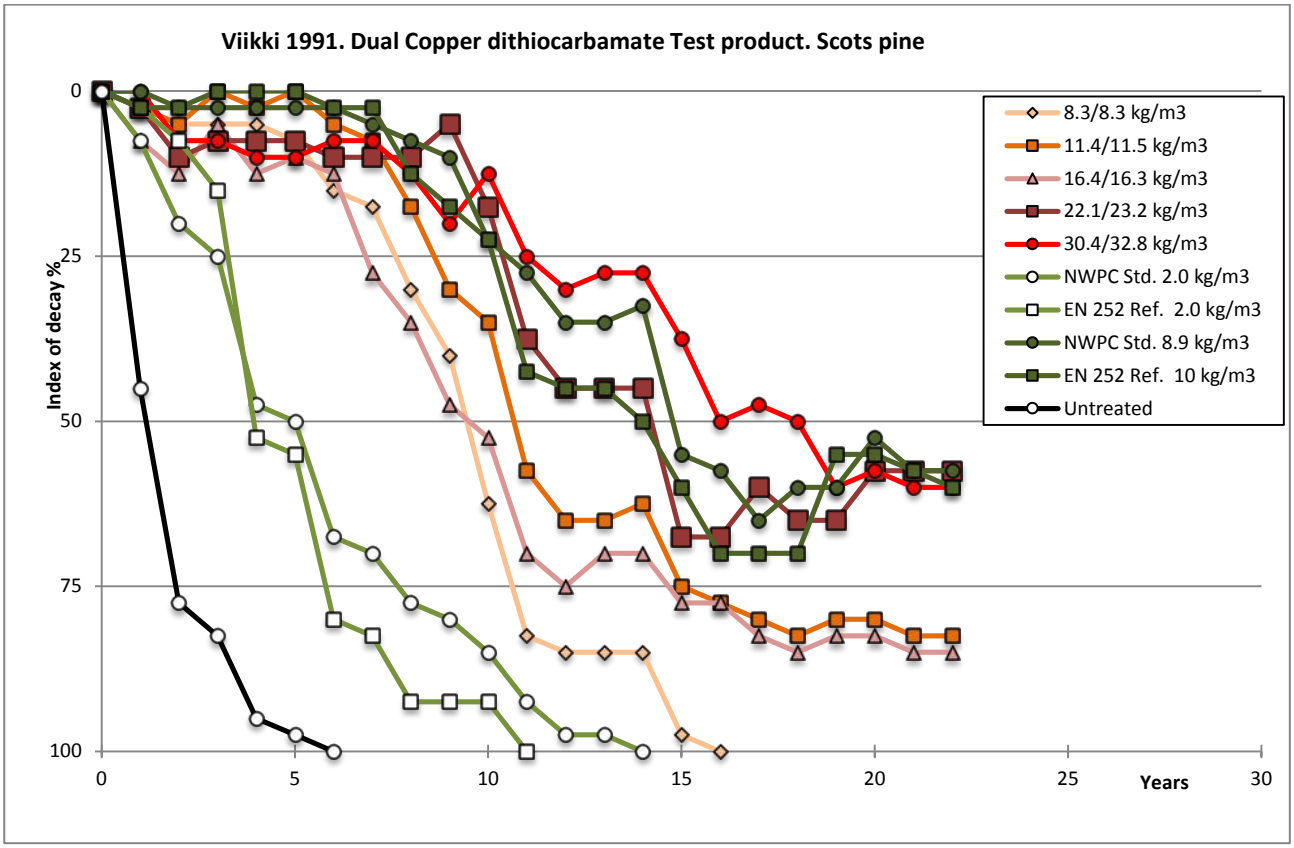
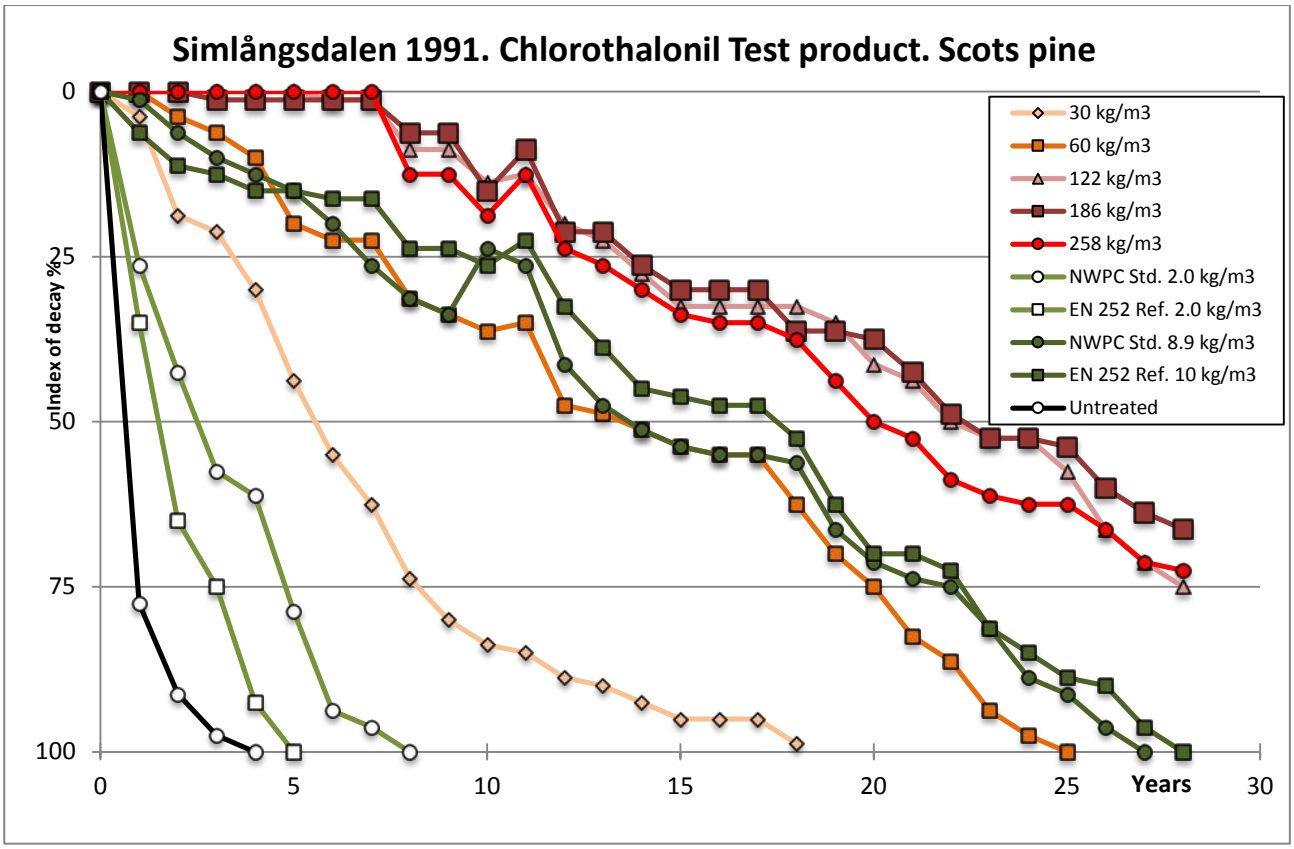


Figure 115. Field trial 1991. Index of decay for stakes of Scots pine treated with Dual copper dithiocarbamate Test product.



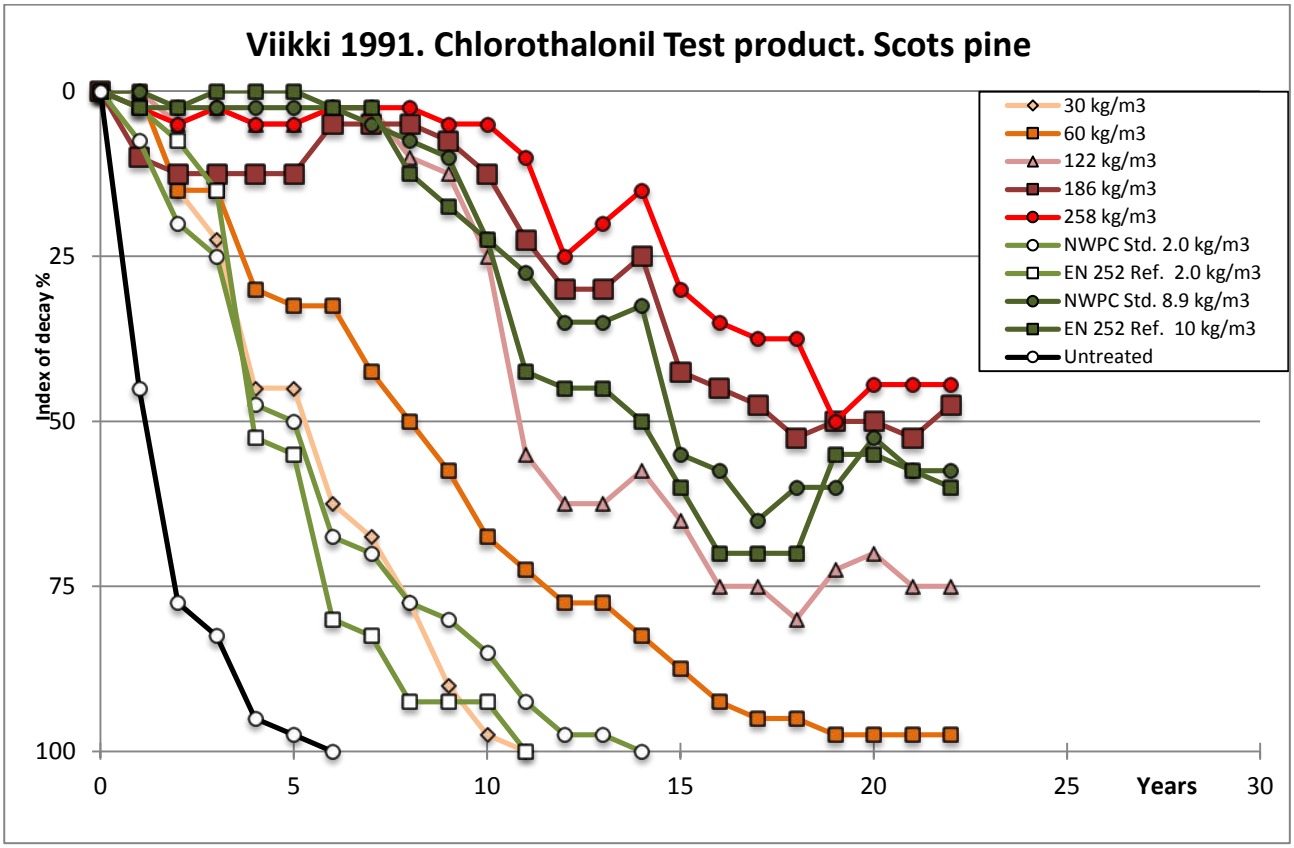
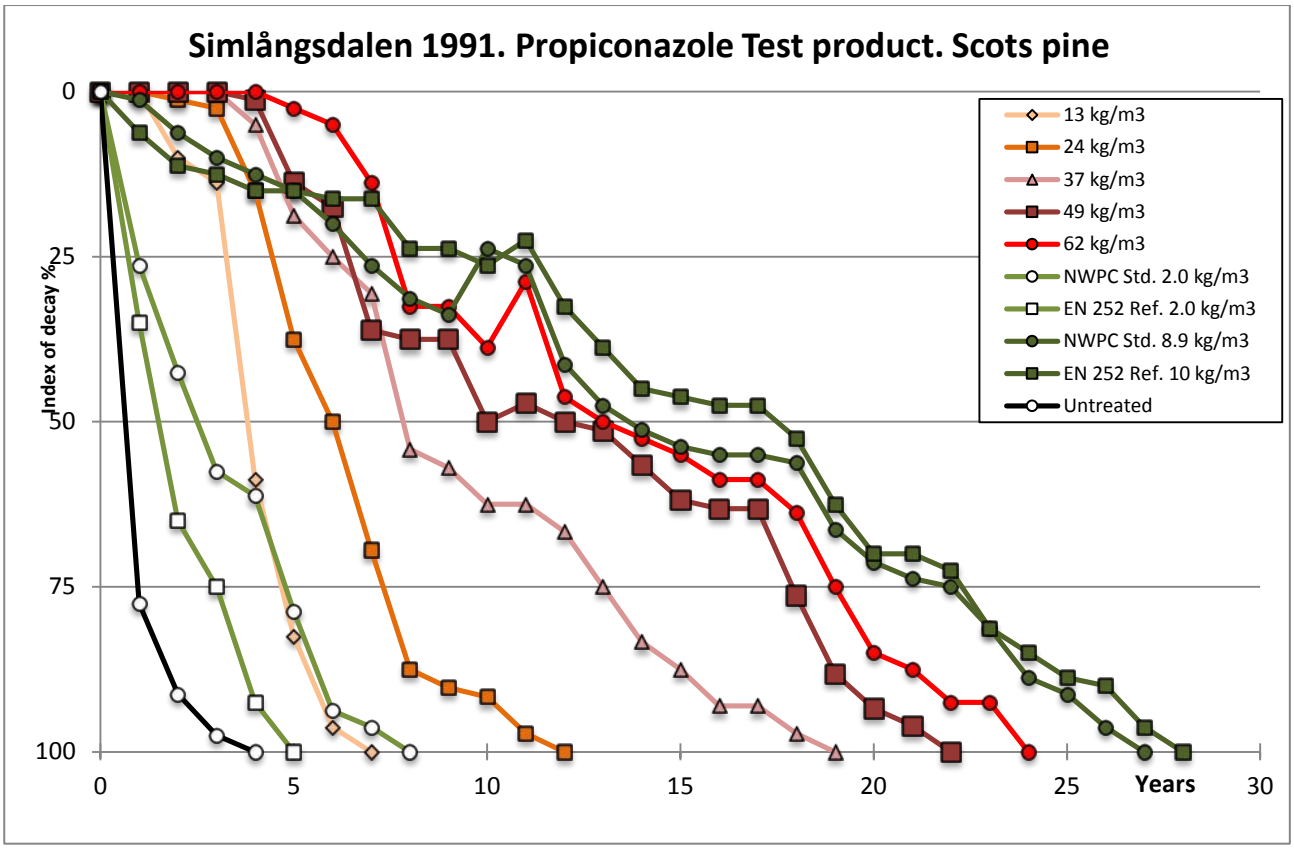


Figure 116. Field trial 1991. Index of decay for stakes of Scots pine treated with Chlorothalonil Test product.



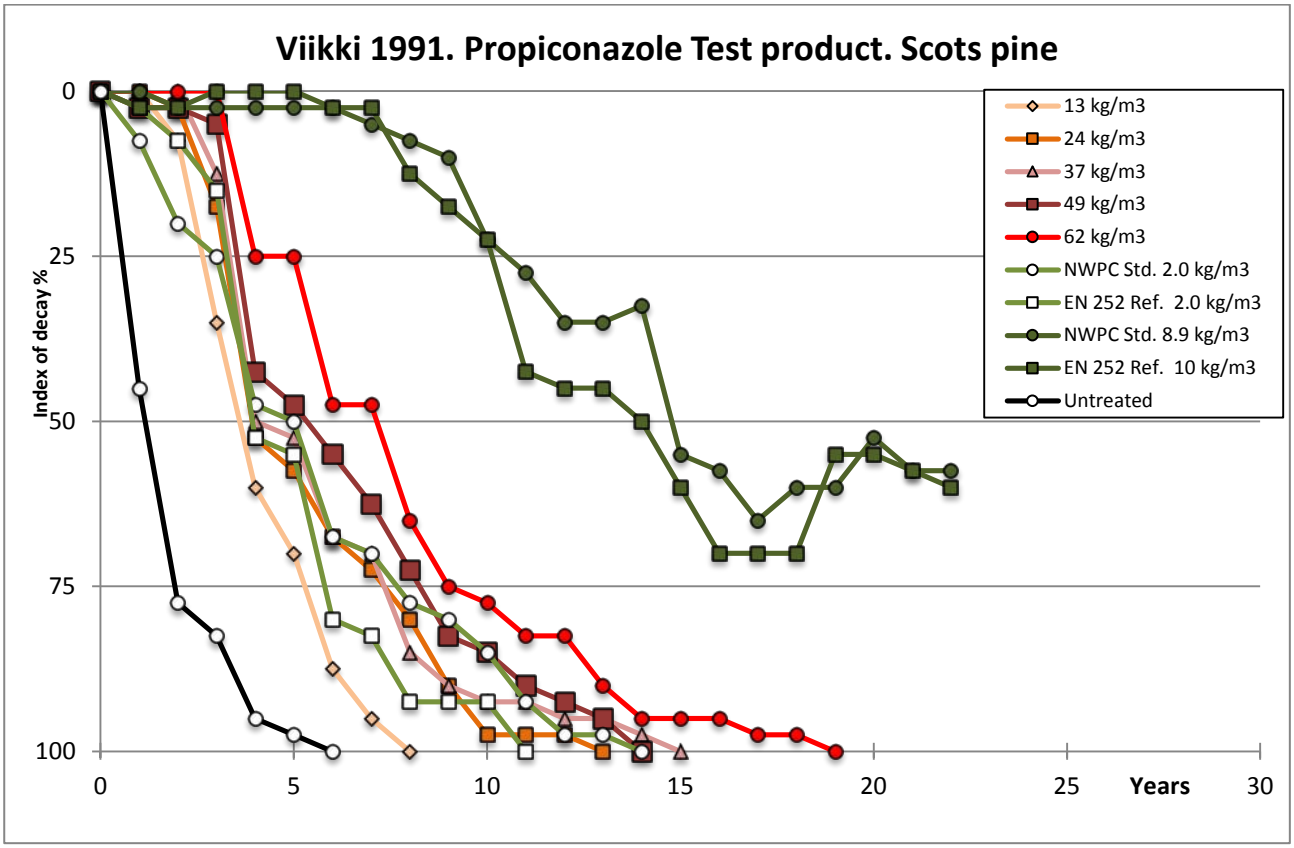
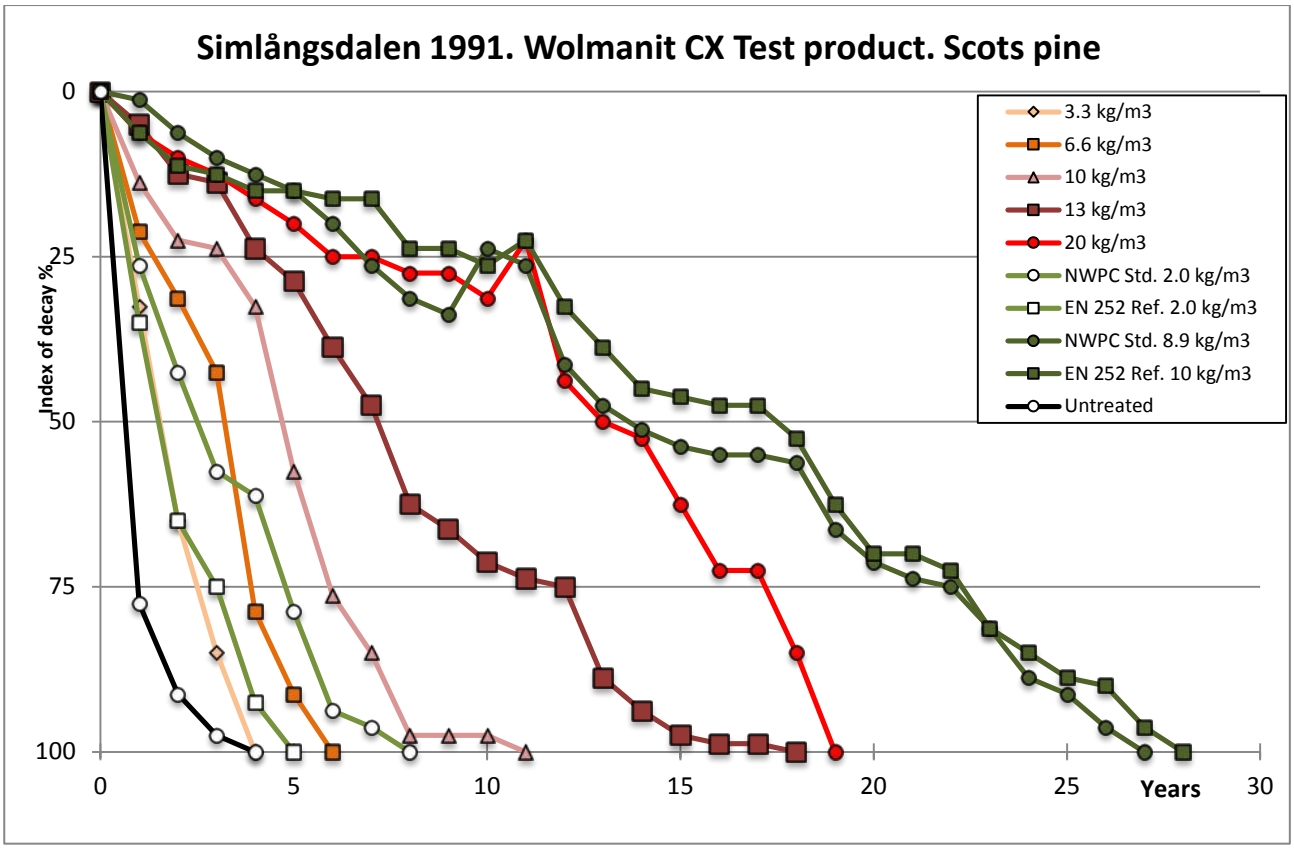


Figure 117. Field trial 1991. Index of decay for stakes of Scots pine treated with Propicanazole Test product.



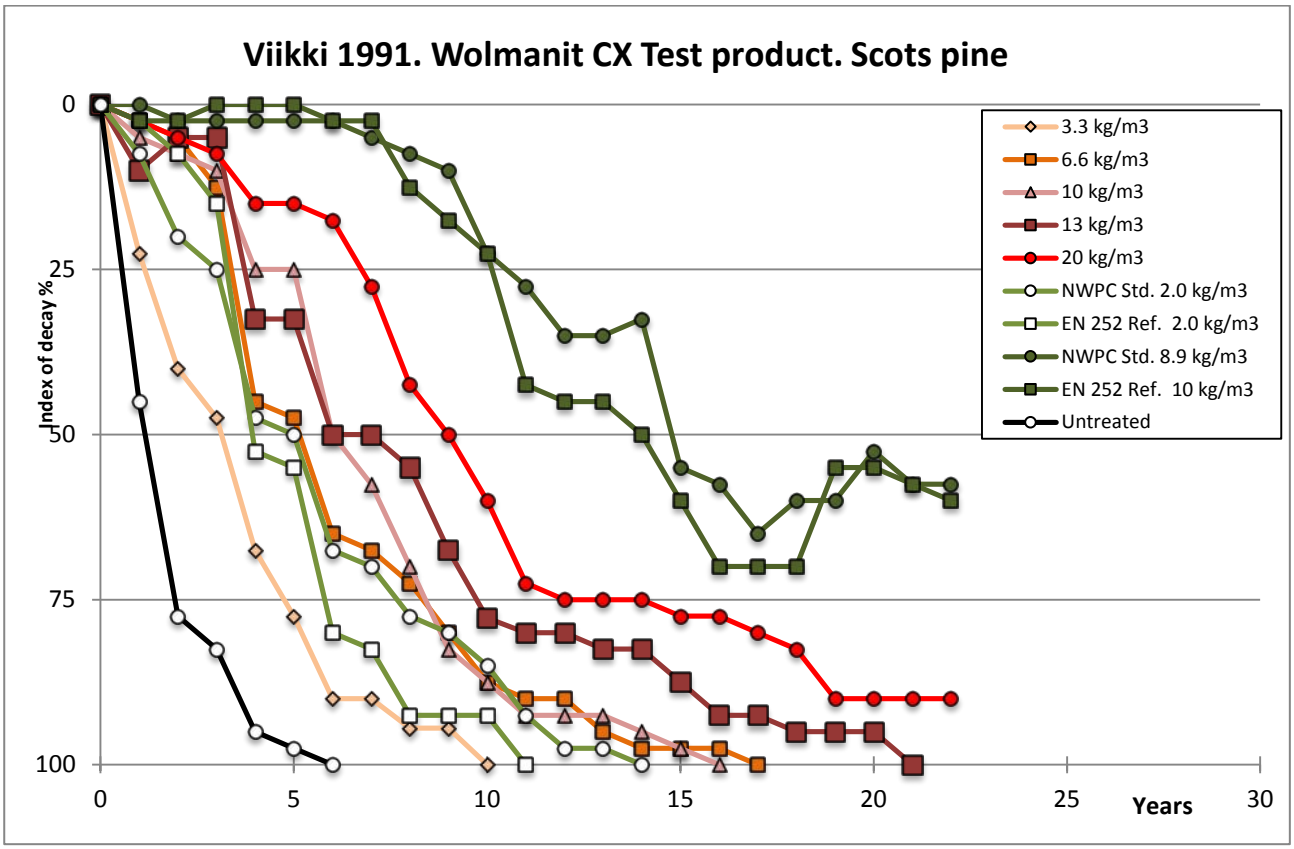
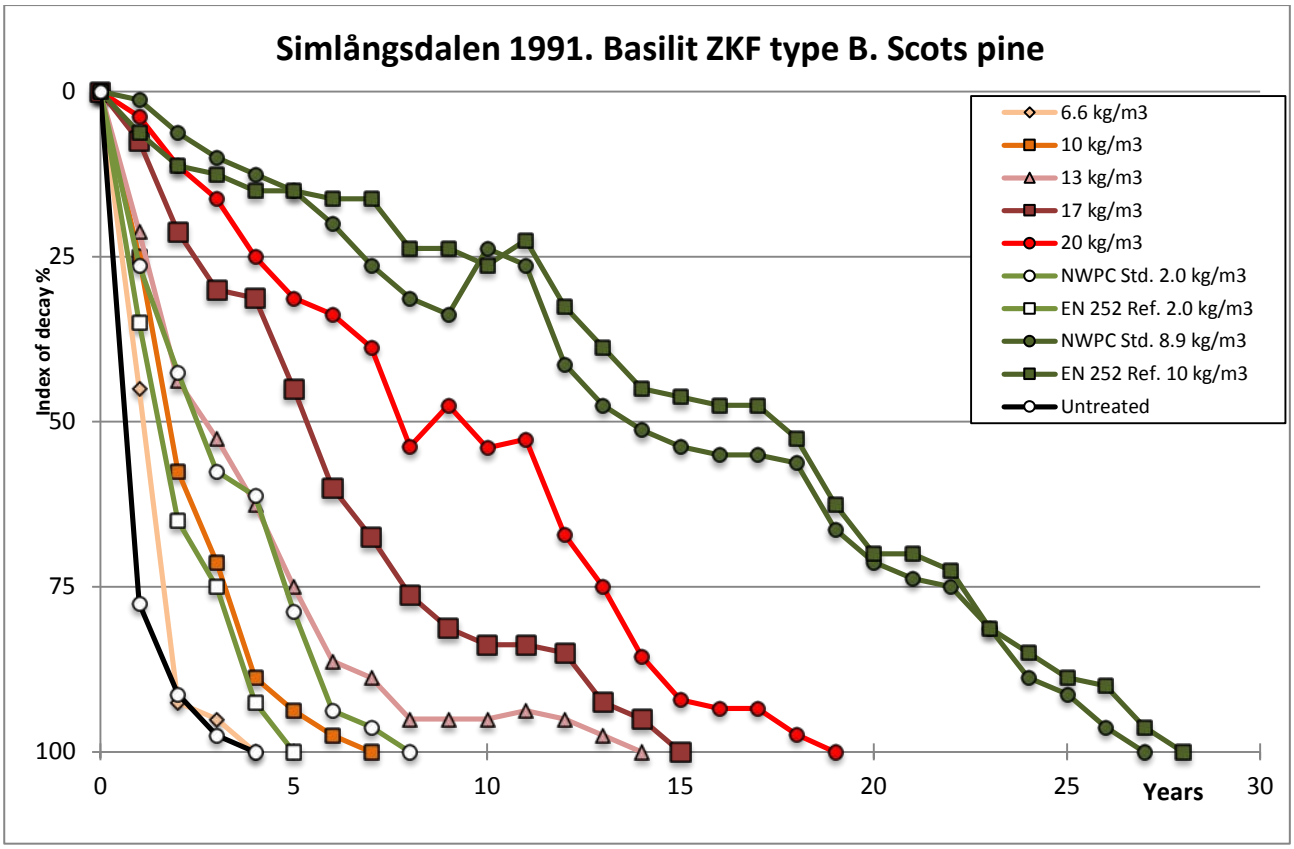


Figure 118. Field trial 1991. Index of decay for stakes of Scots pine treated with Wolmanit CX Test product.



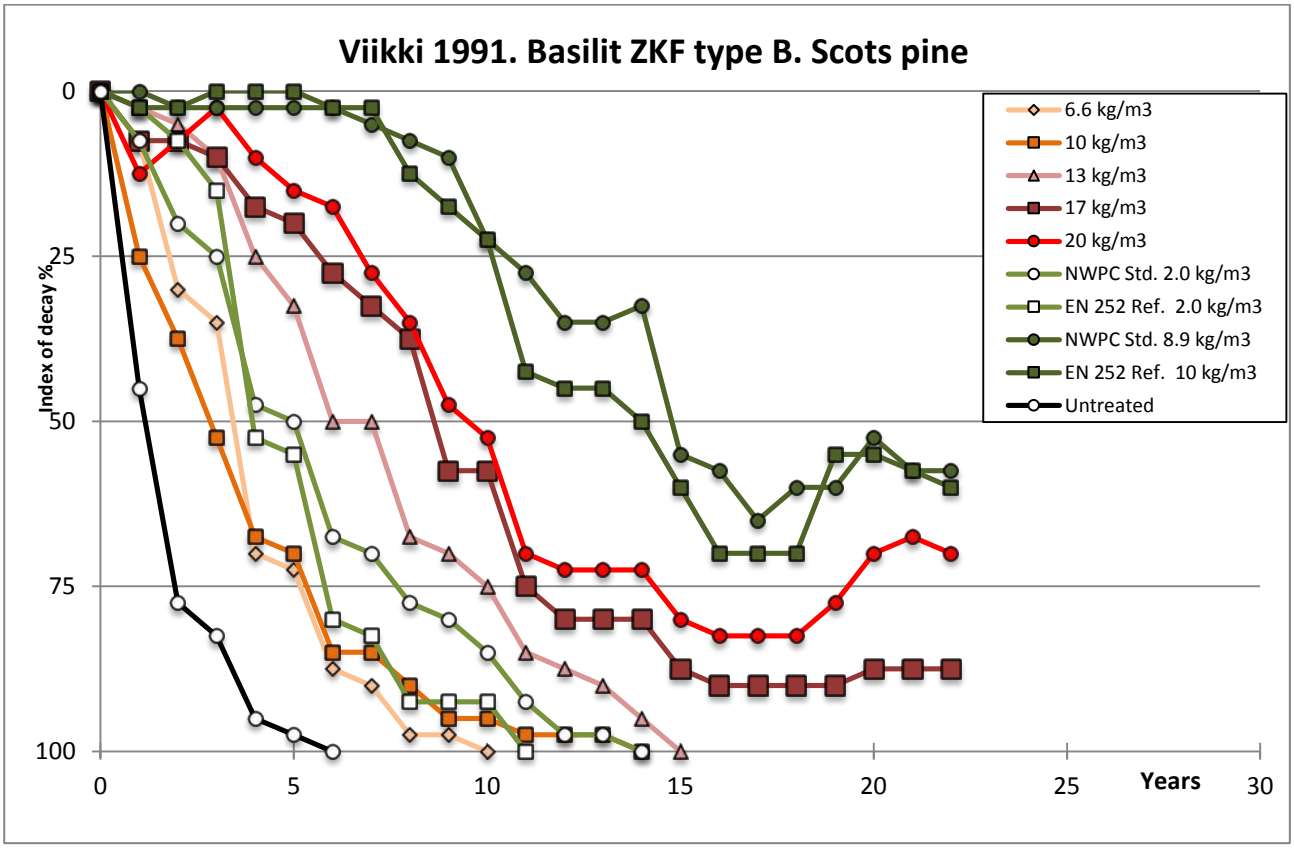
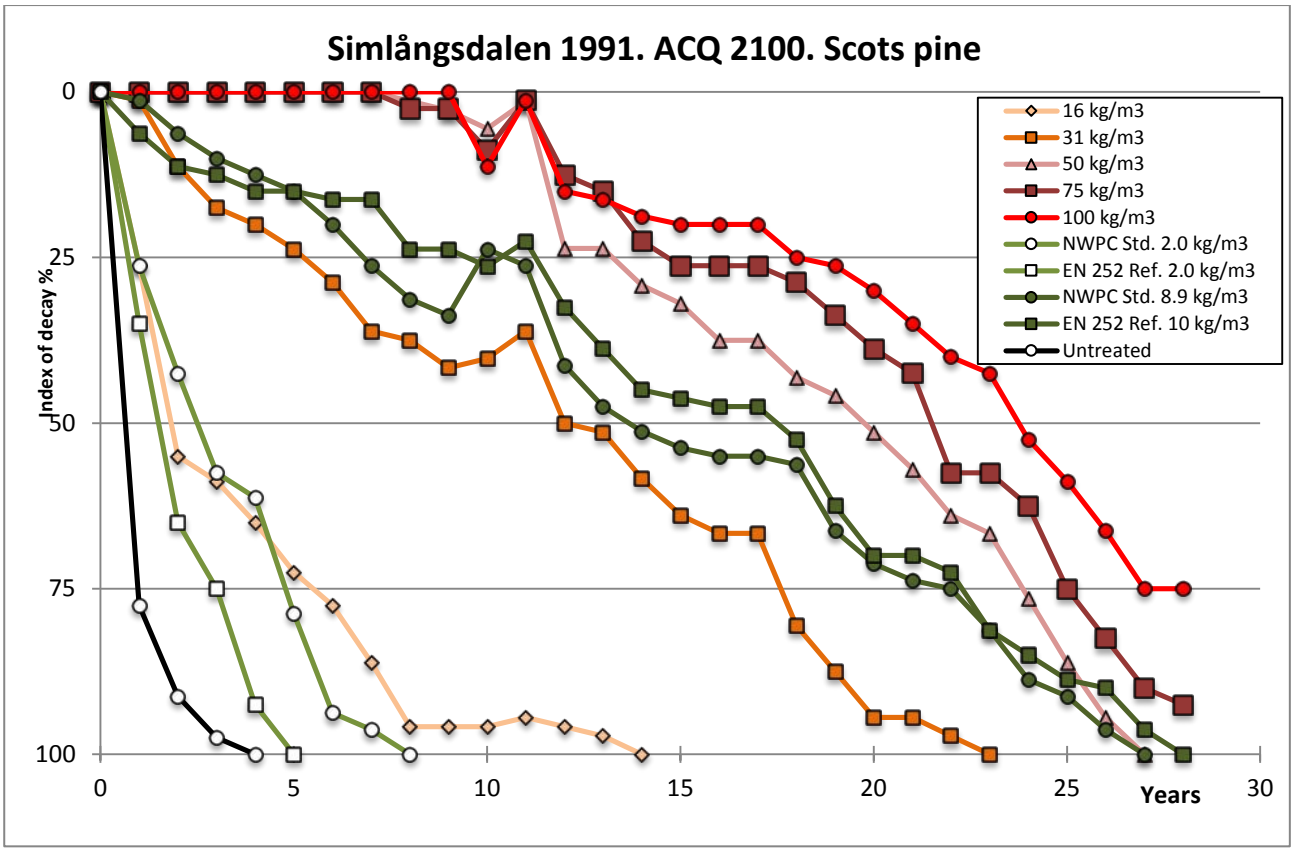


Figure 119. Field trial 1991. Index of decay for stakes of Scots pine treated with Basilit ZKF type B.



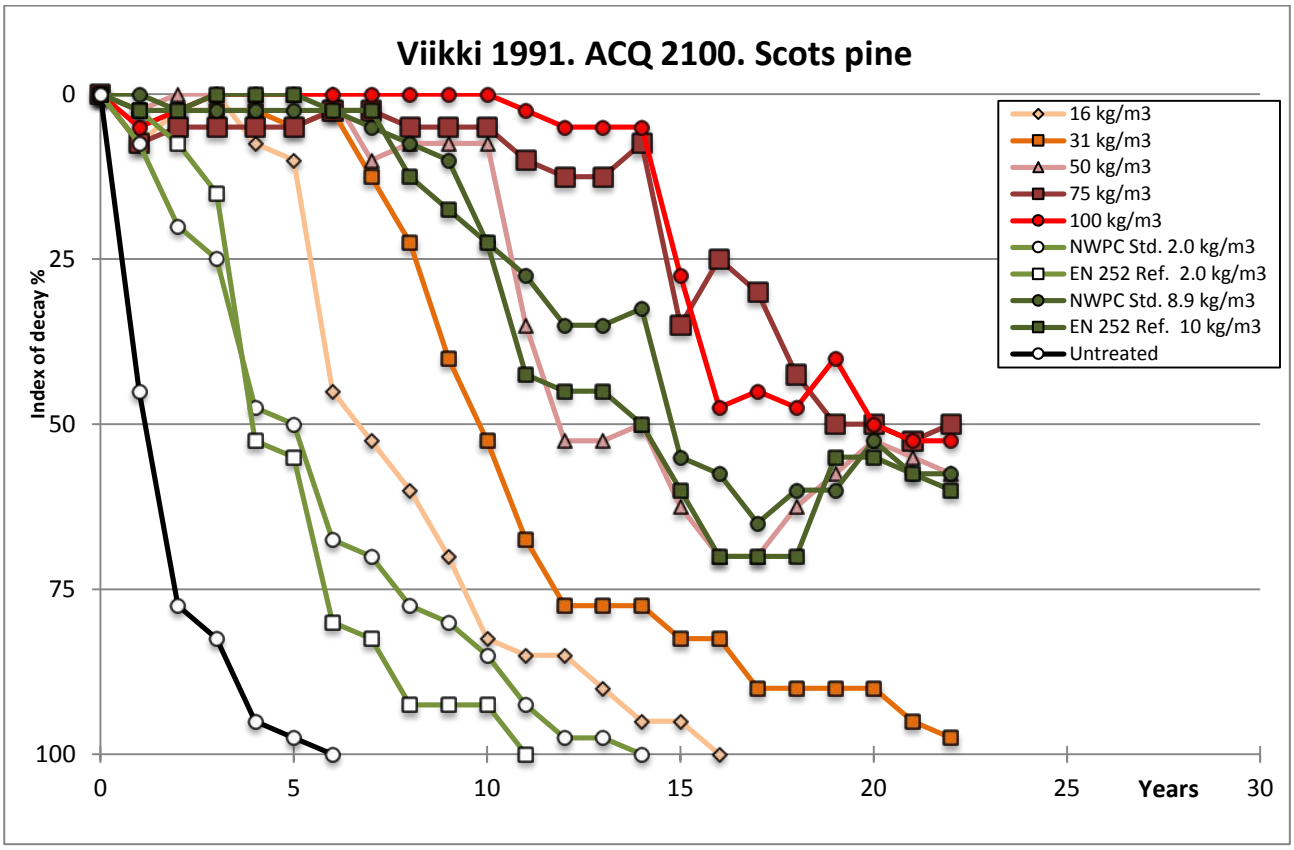


Figure 120. Field trial 1991. Index of decay for stakes of Scots pine treated with ACQ 2100.

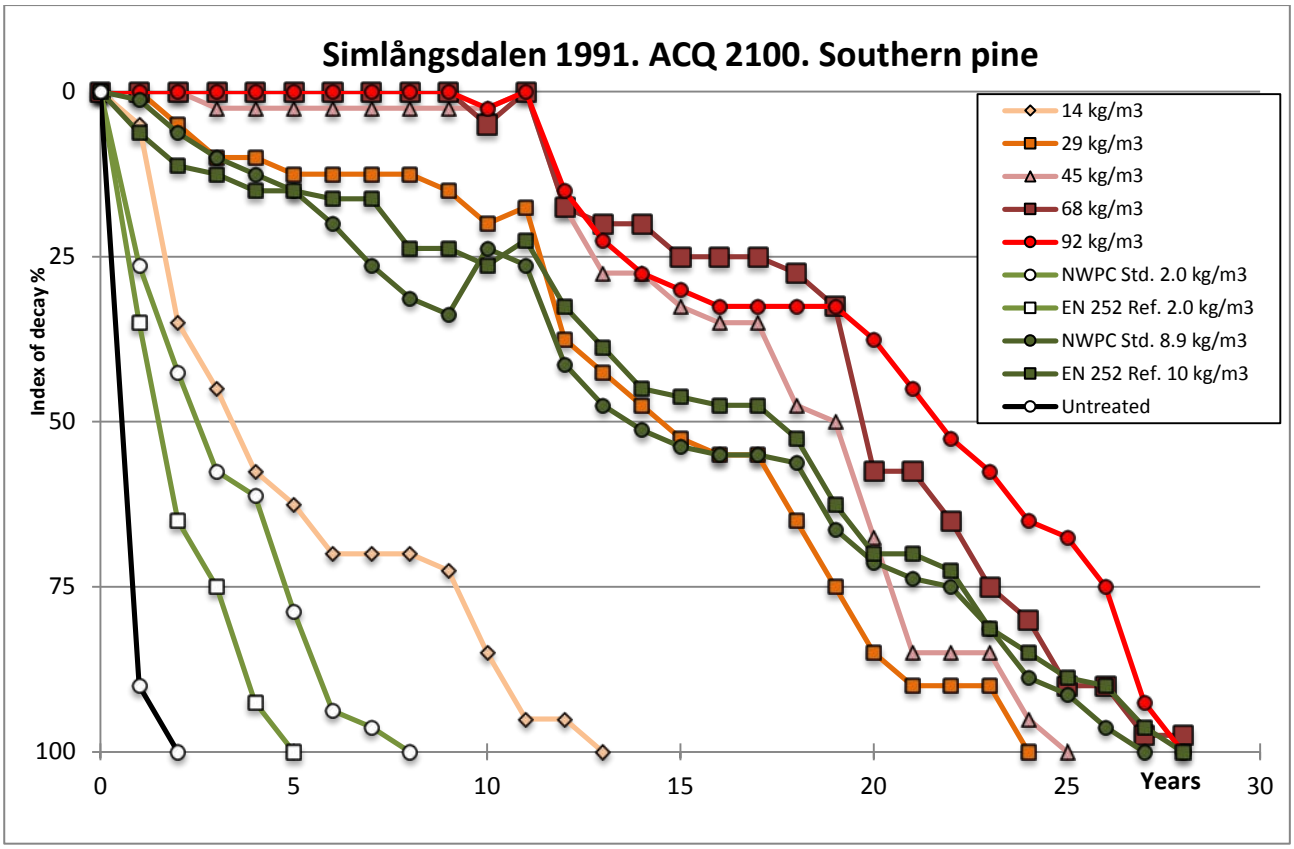
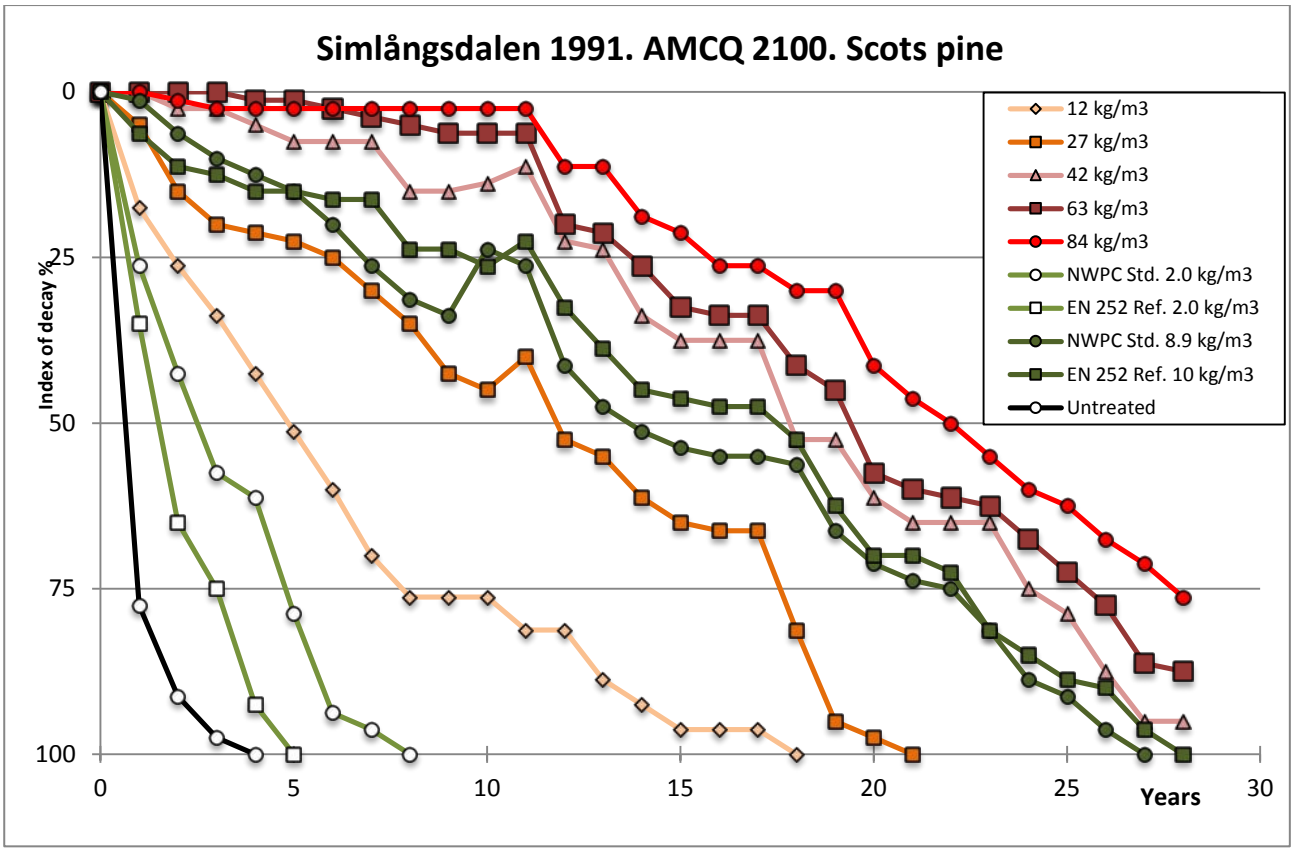


Figure 121. Field trial 1991. Index of decay for stakes of Southern pine treated with ACQ 2100.



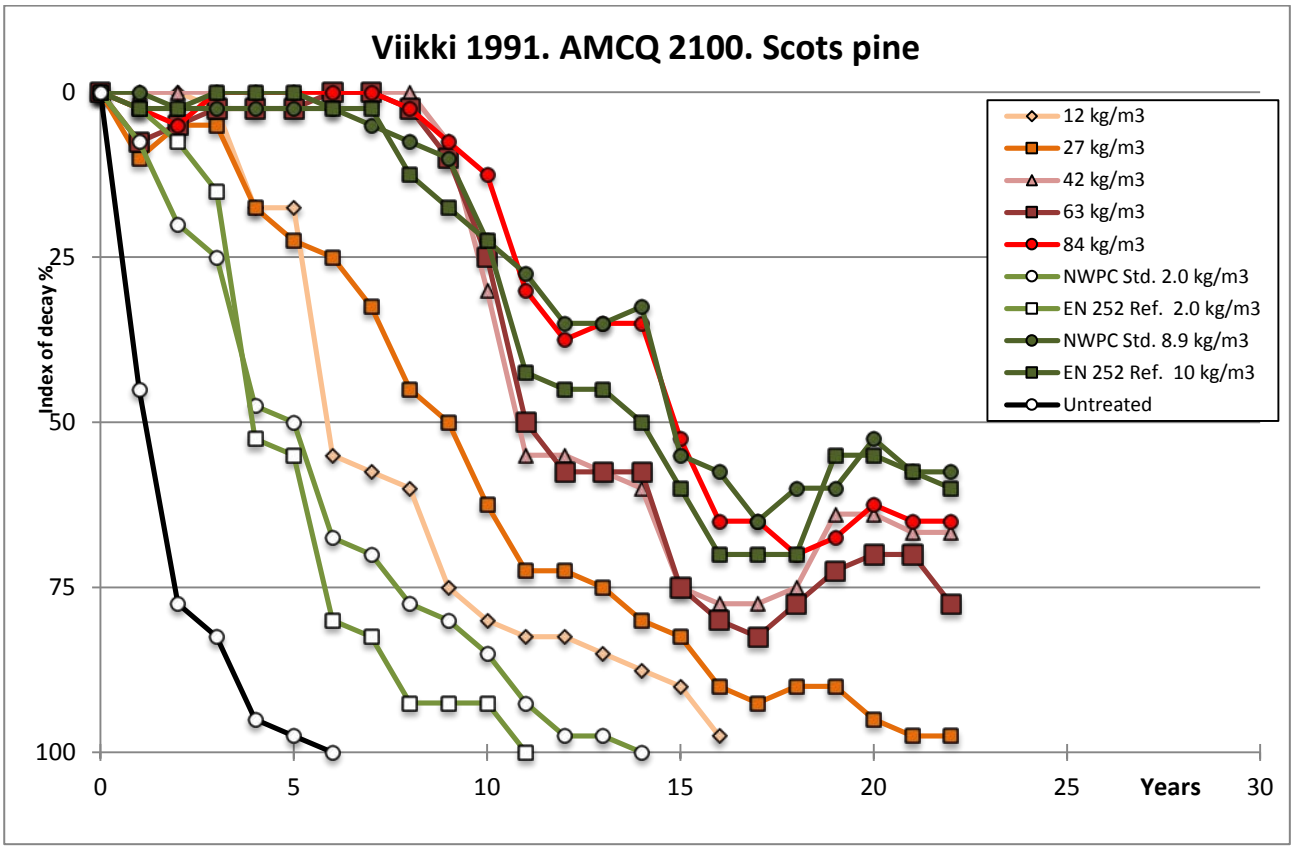
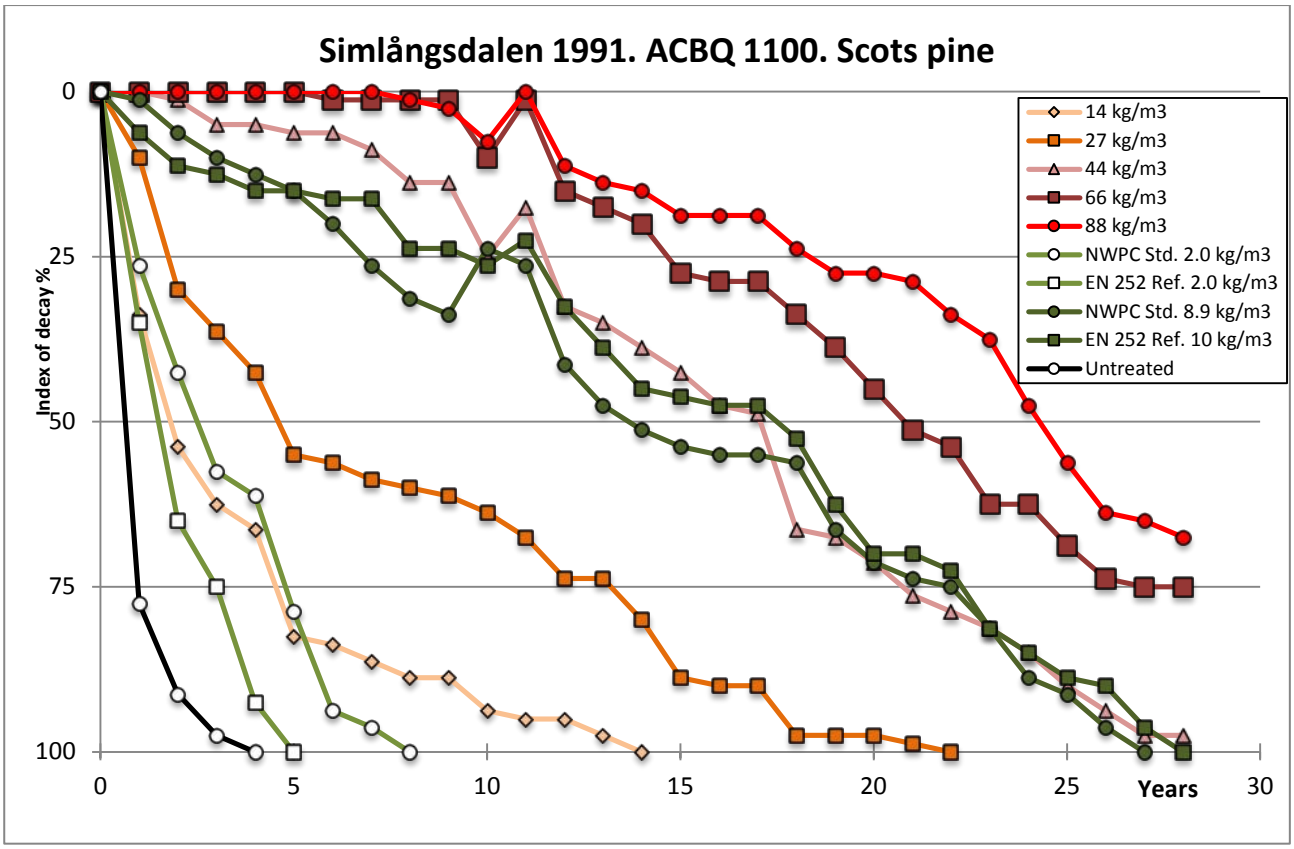


Figure 122. Field trial 1991. Index of decay for stakes of Scots pine treated with AMCQ 2100.



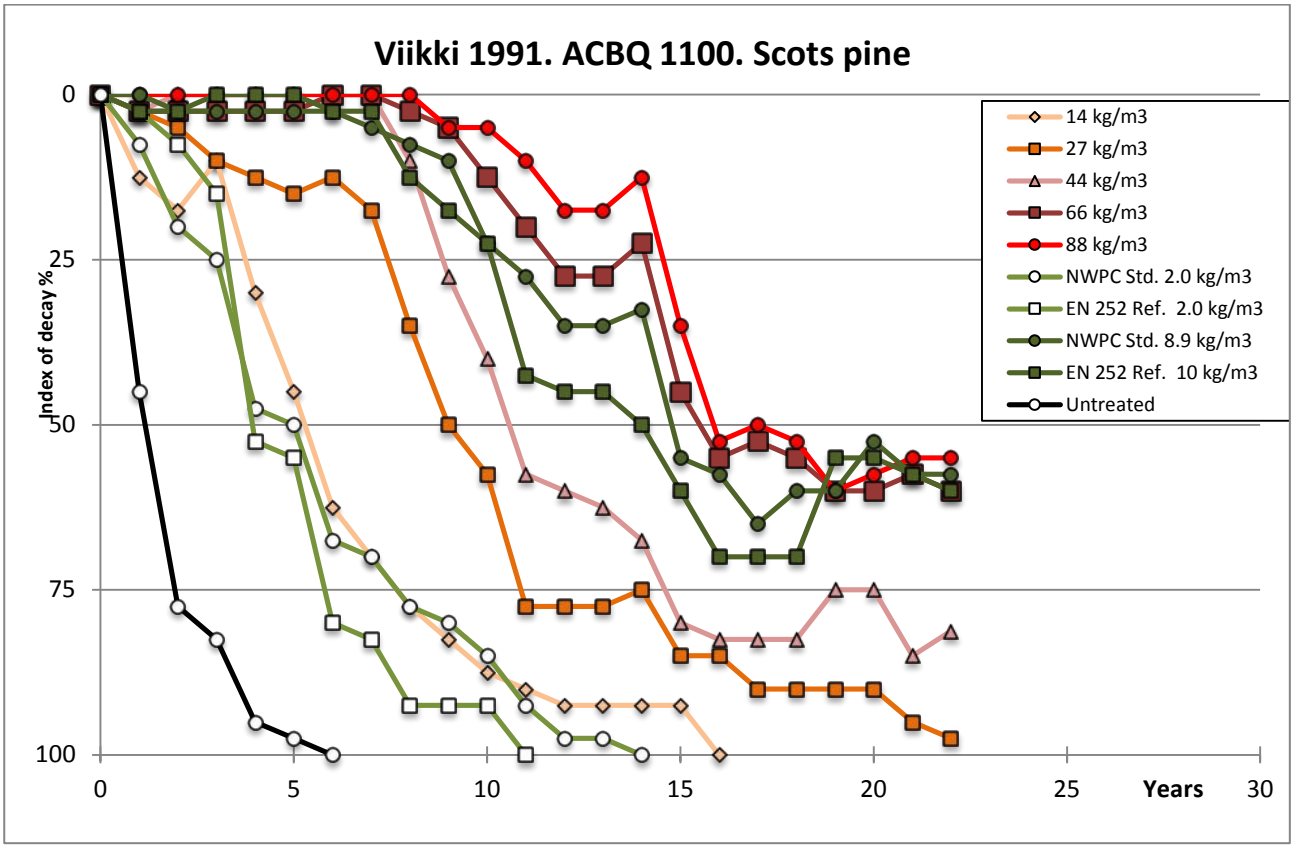
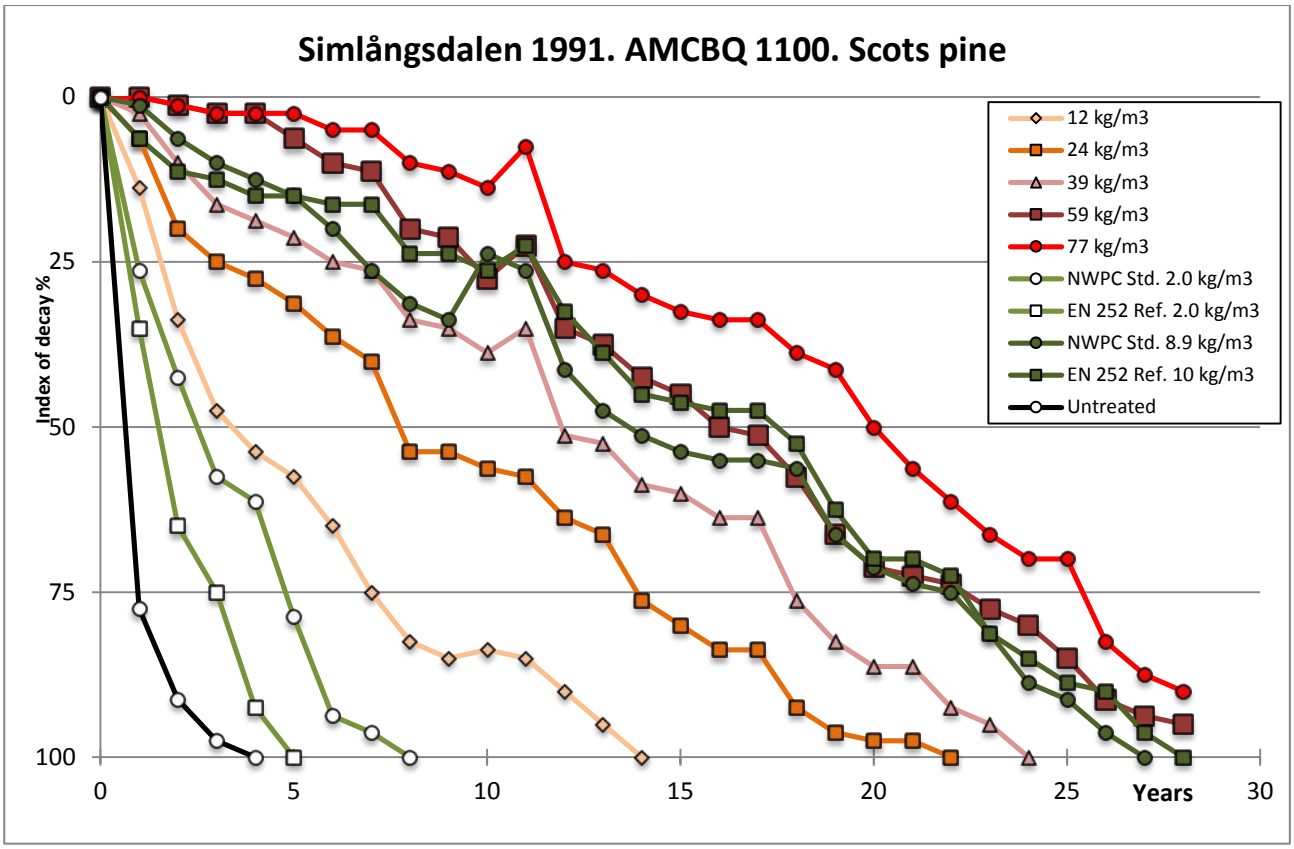


Figure 123. Field trial 1991. Index of decay for stakes of Scots pine treated with ACBQ 1100.



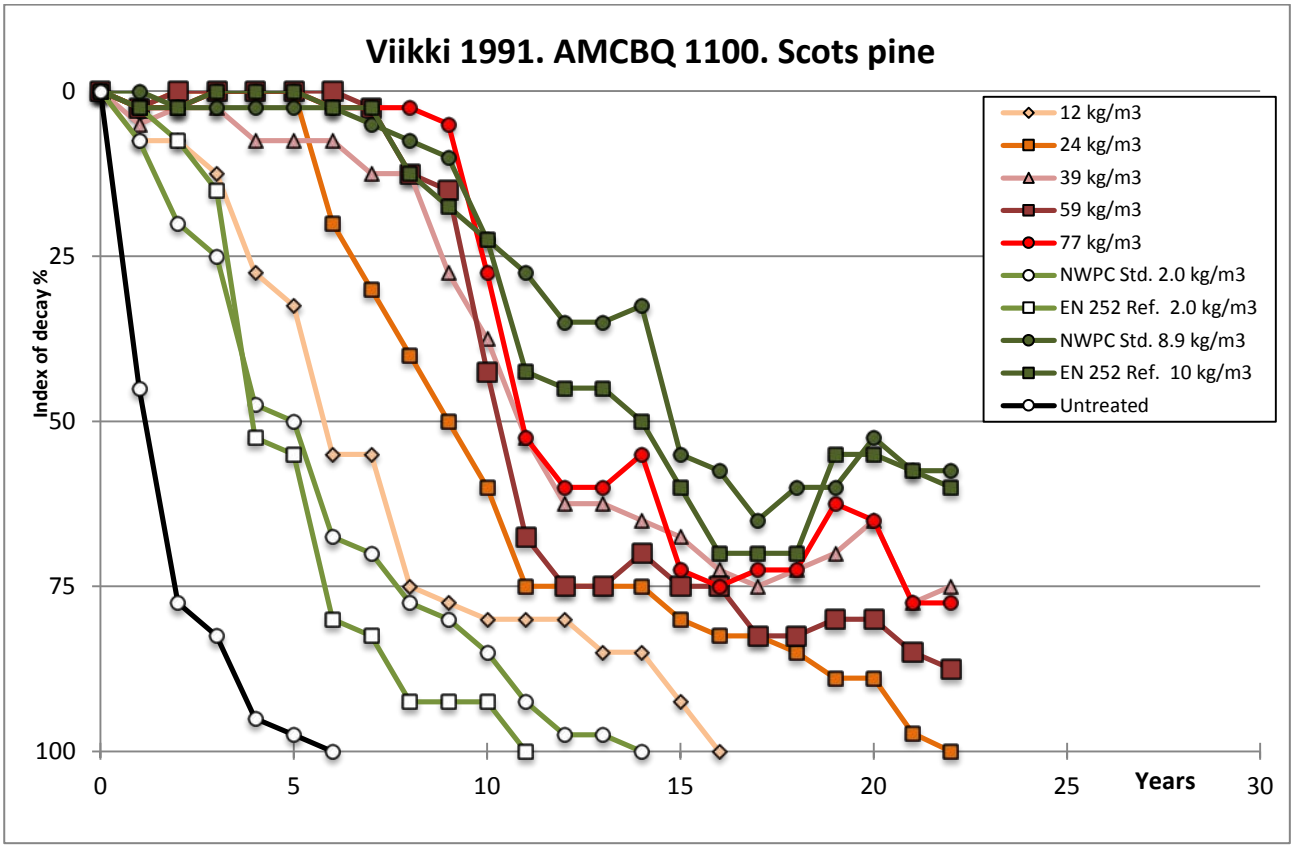
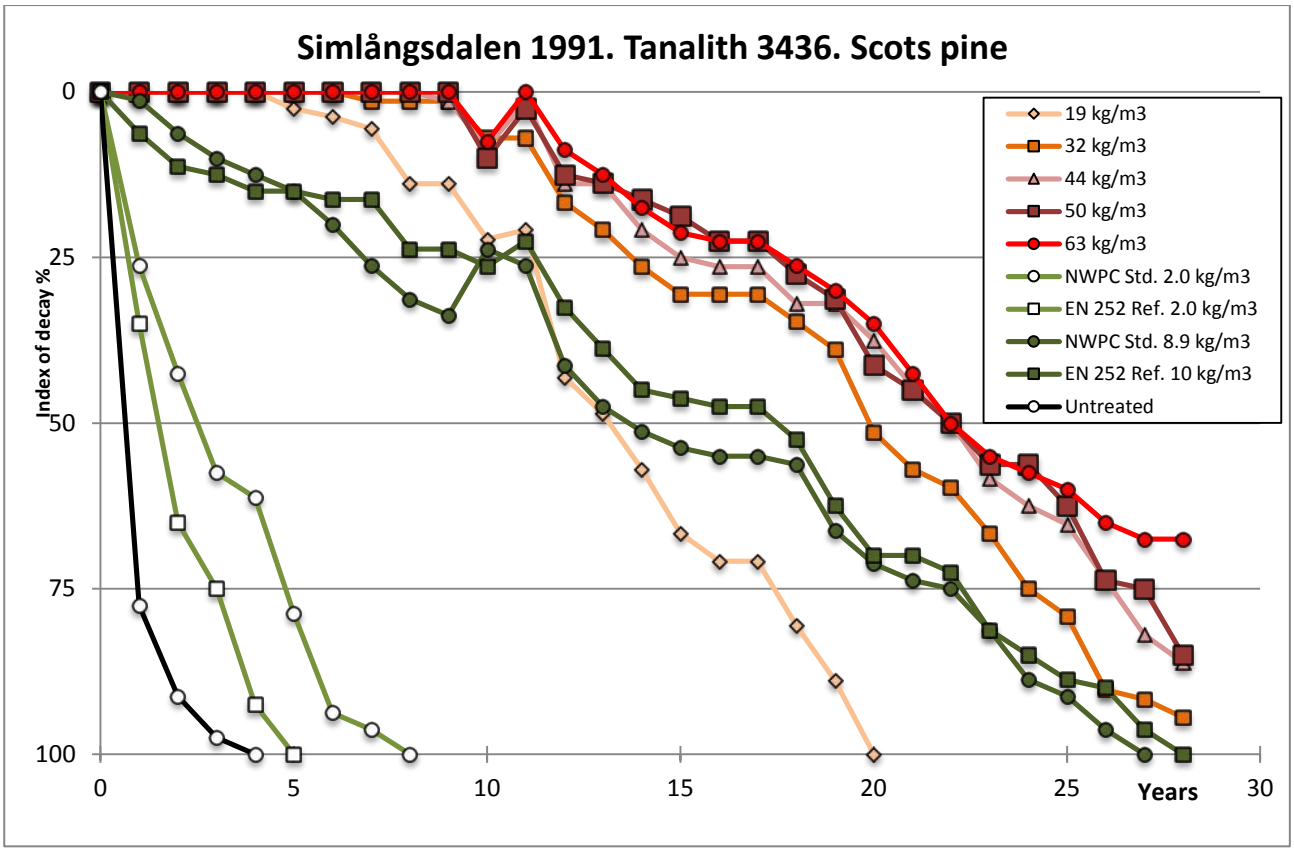


Figure 124. Field trial 1991. Index of decay for stakes of Scots pine treated with AMCBQ 1100.



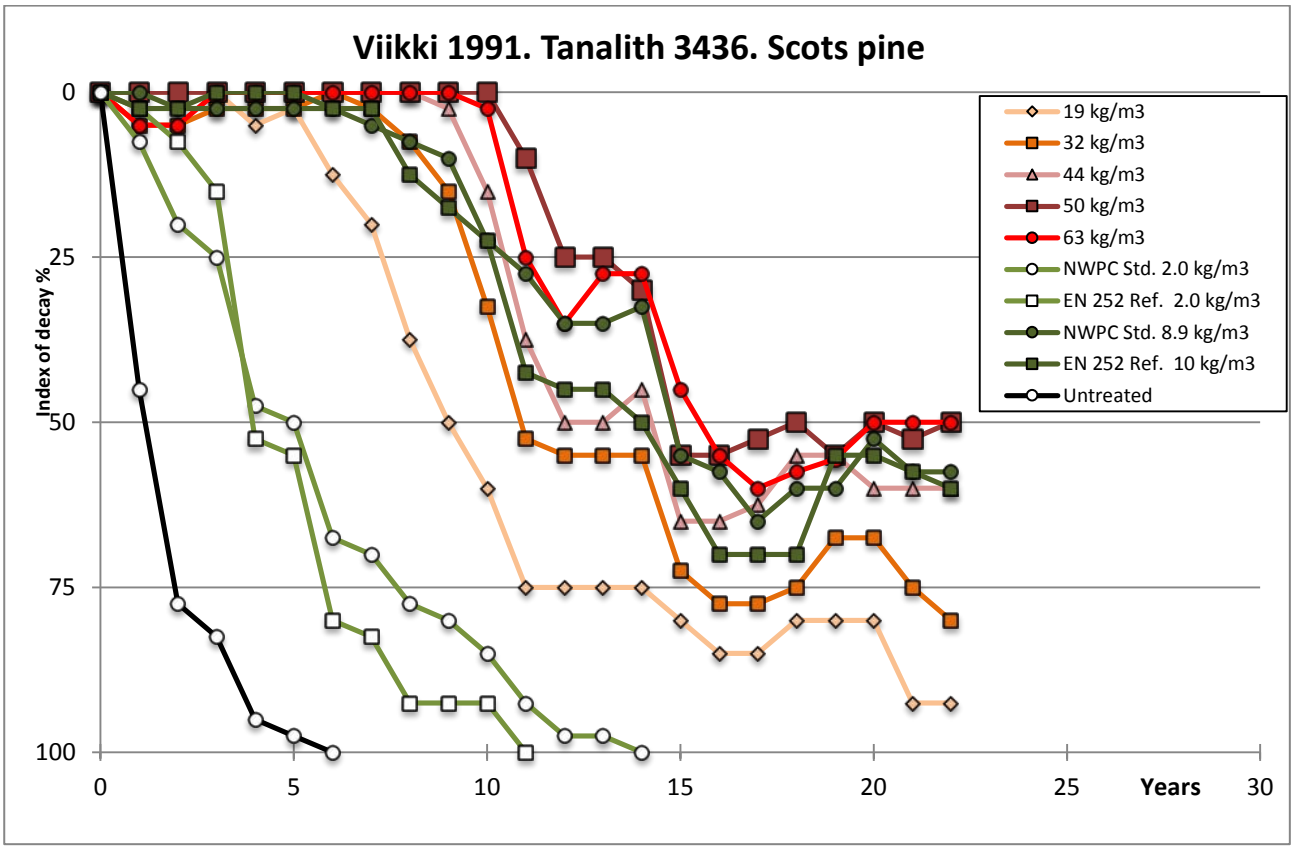
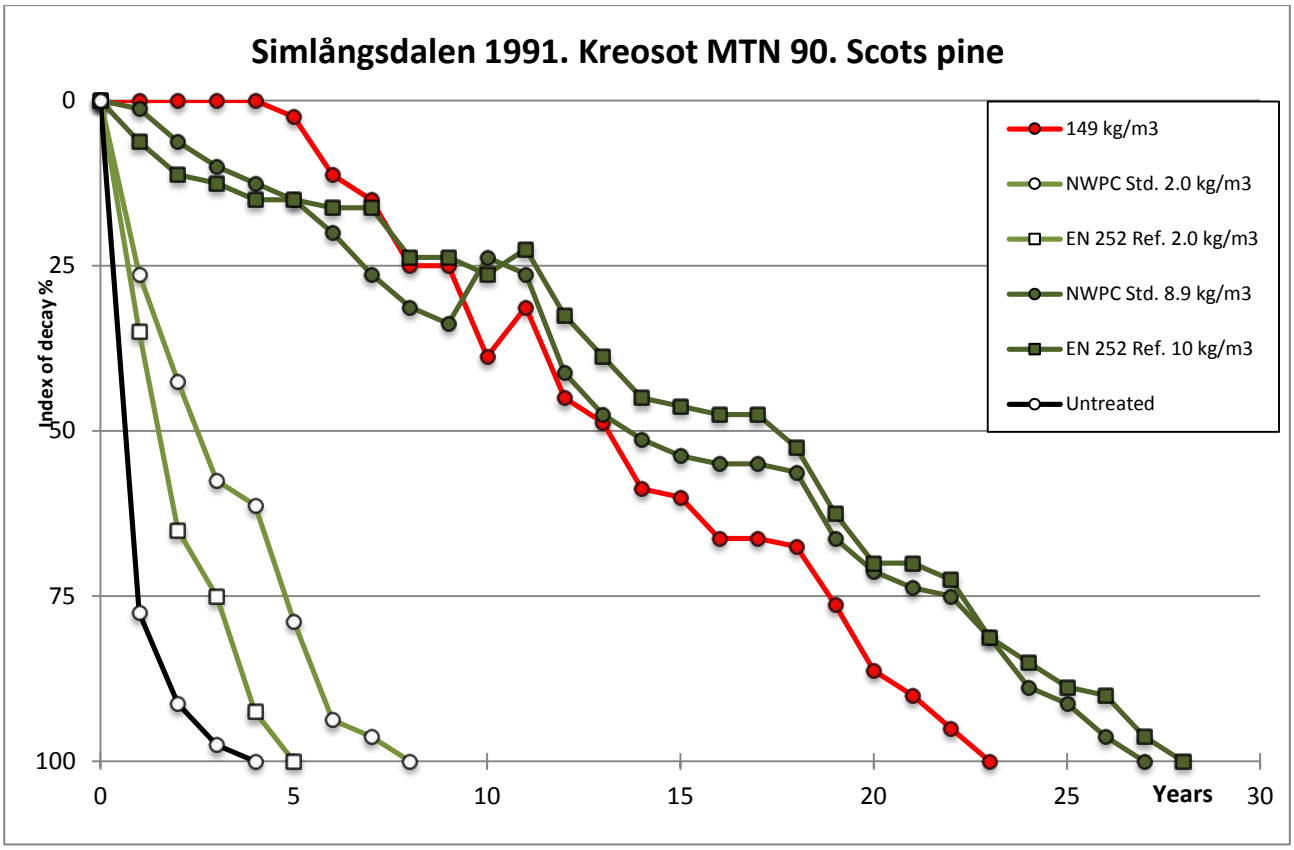


Figure 125. Field trial 1991. Index of decay for stakes of Scots pine treated with Tanalith 3436.



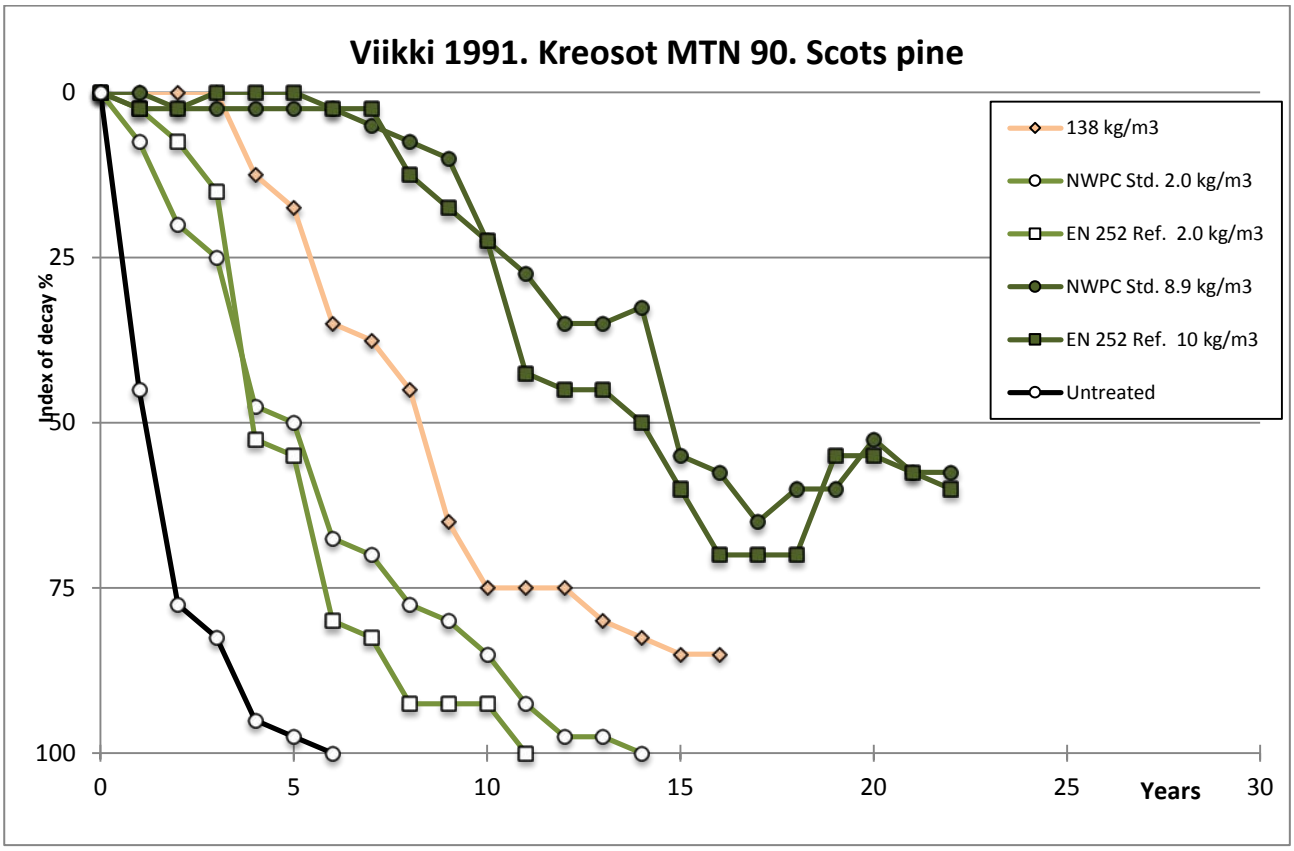
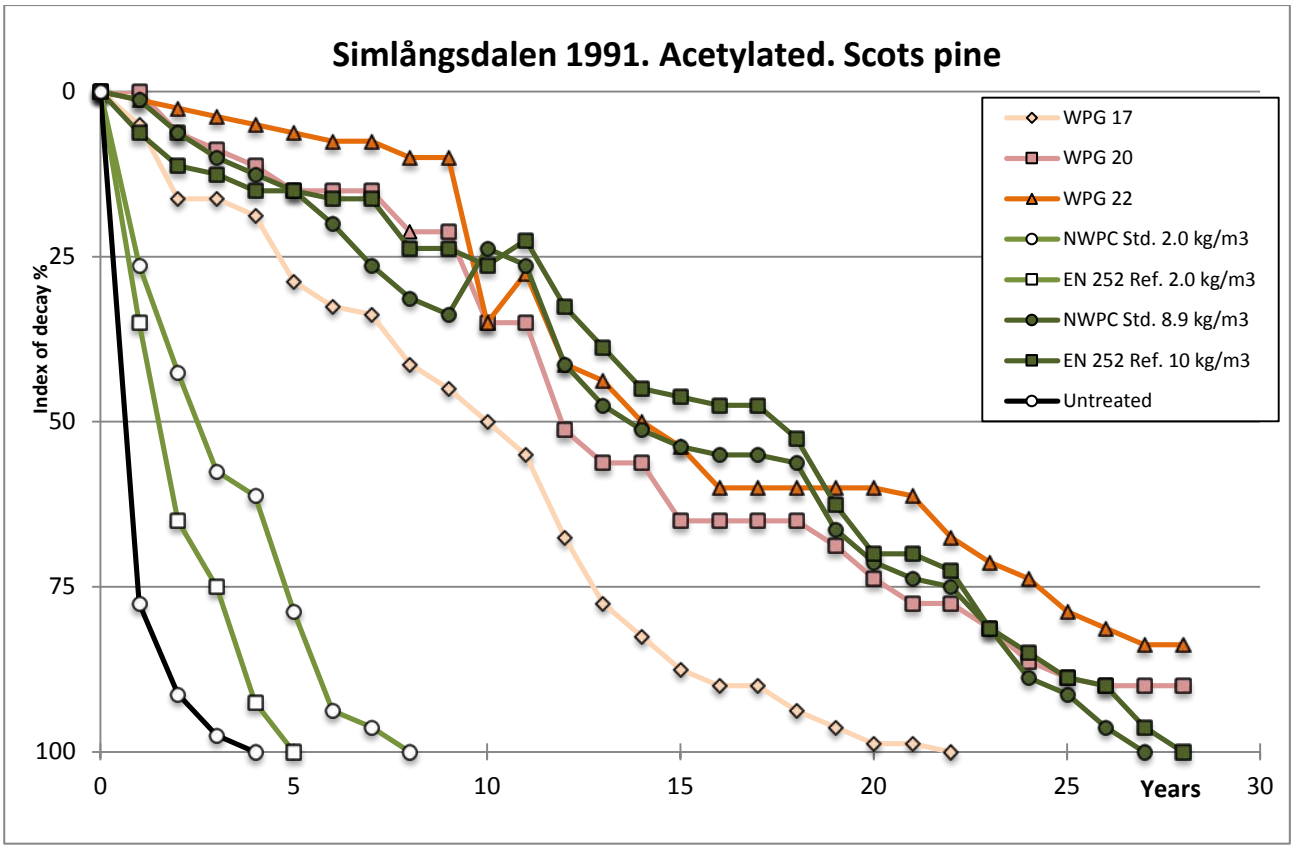


Figure 126. Field trial 1991. Index of decay for stakes of Scots pine treated with Kreosot MTN 90.



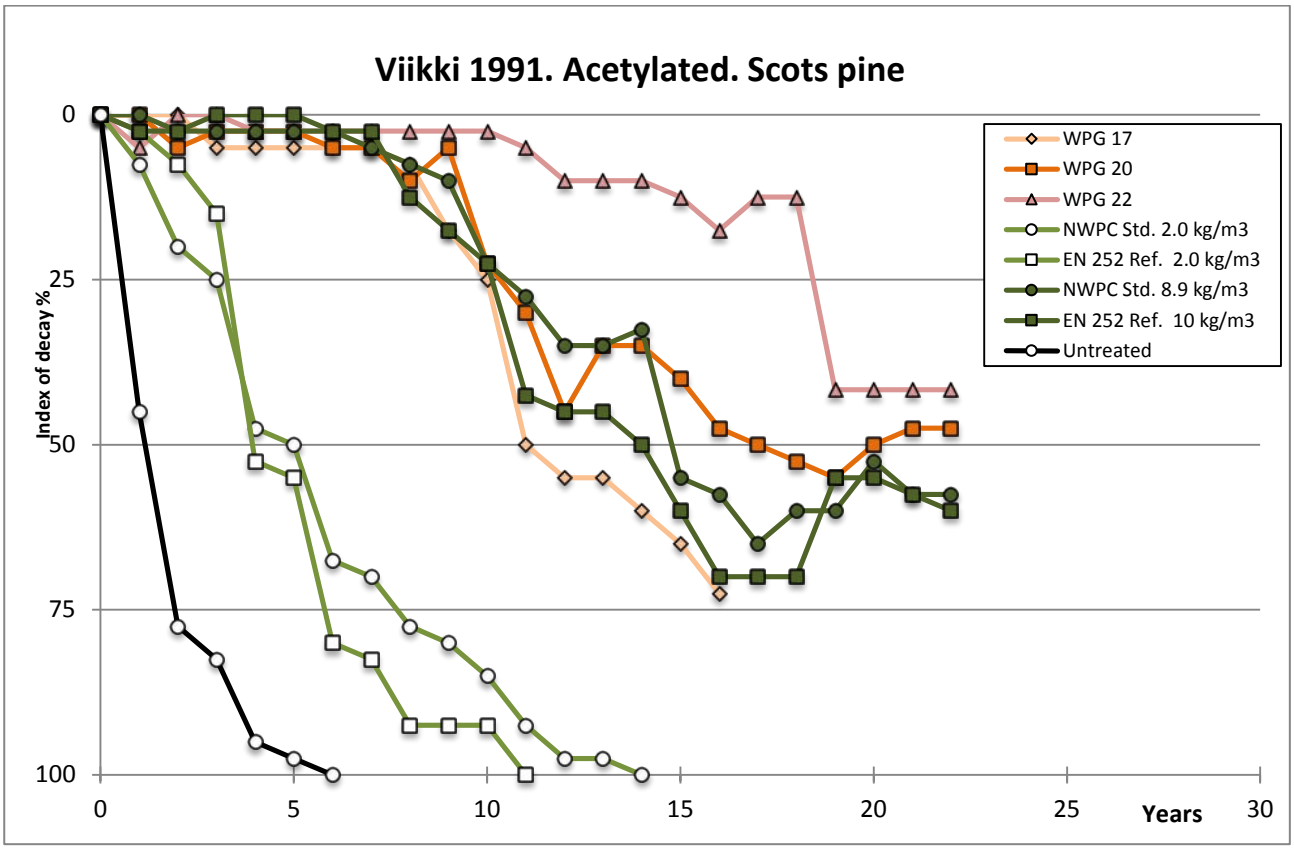
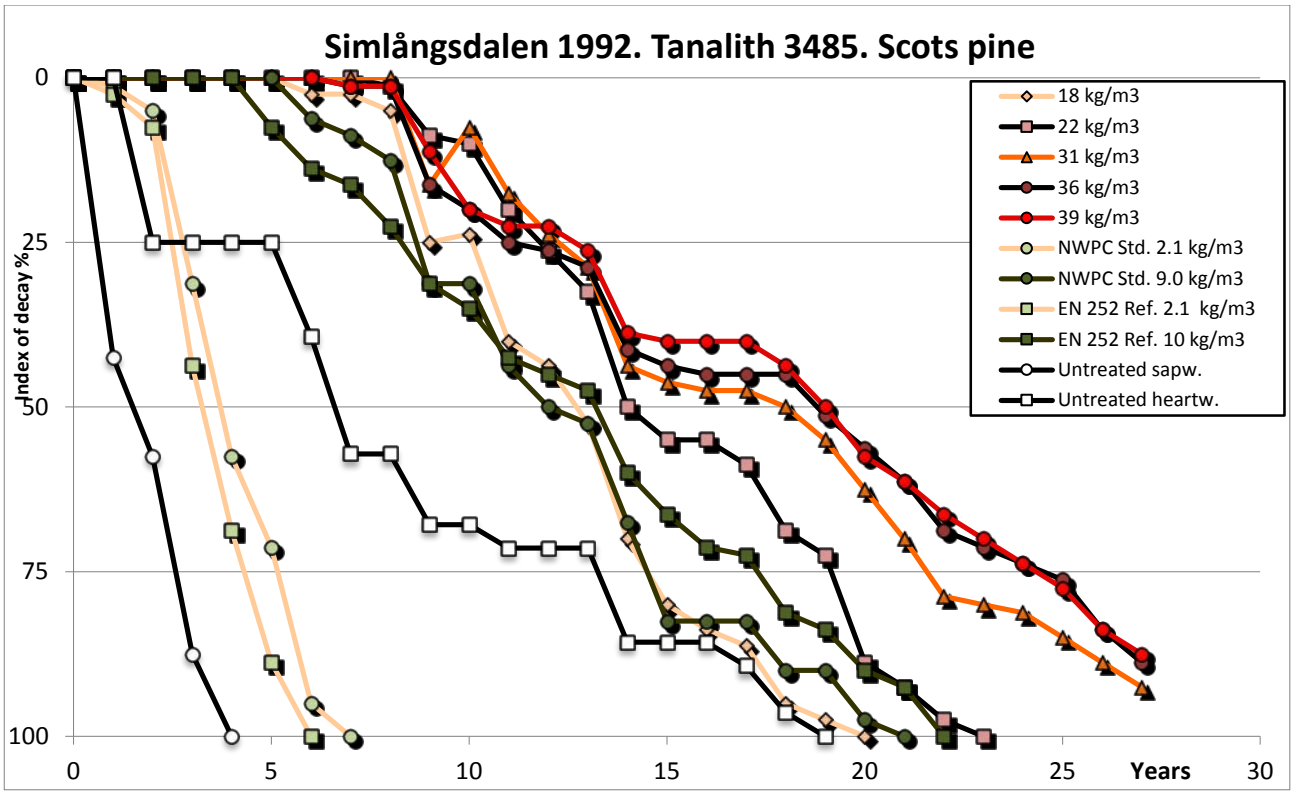


Figure 127. Field trial 1991. Index of decay for stakes of Acetylated Scots pine.



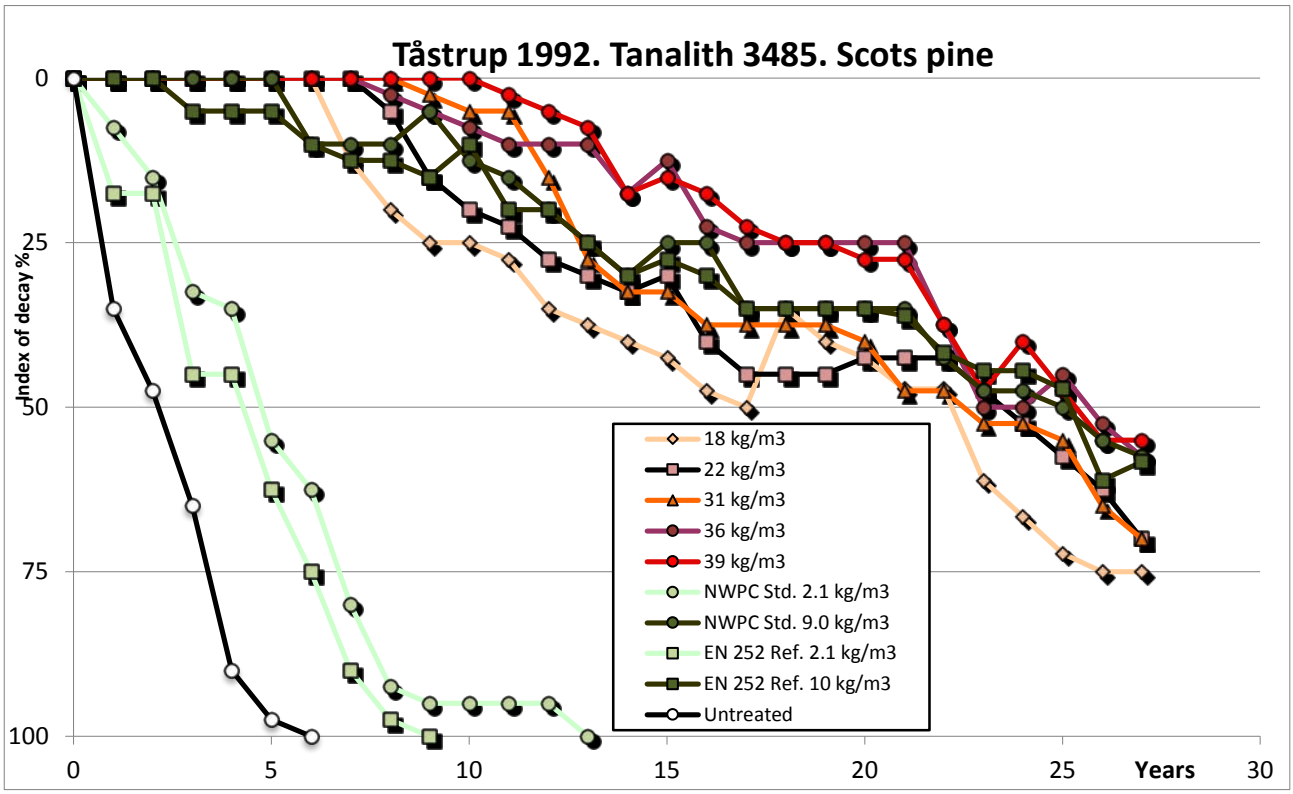
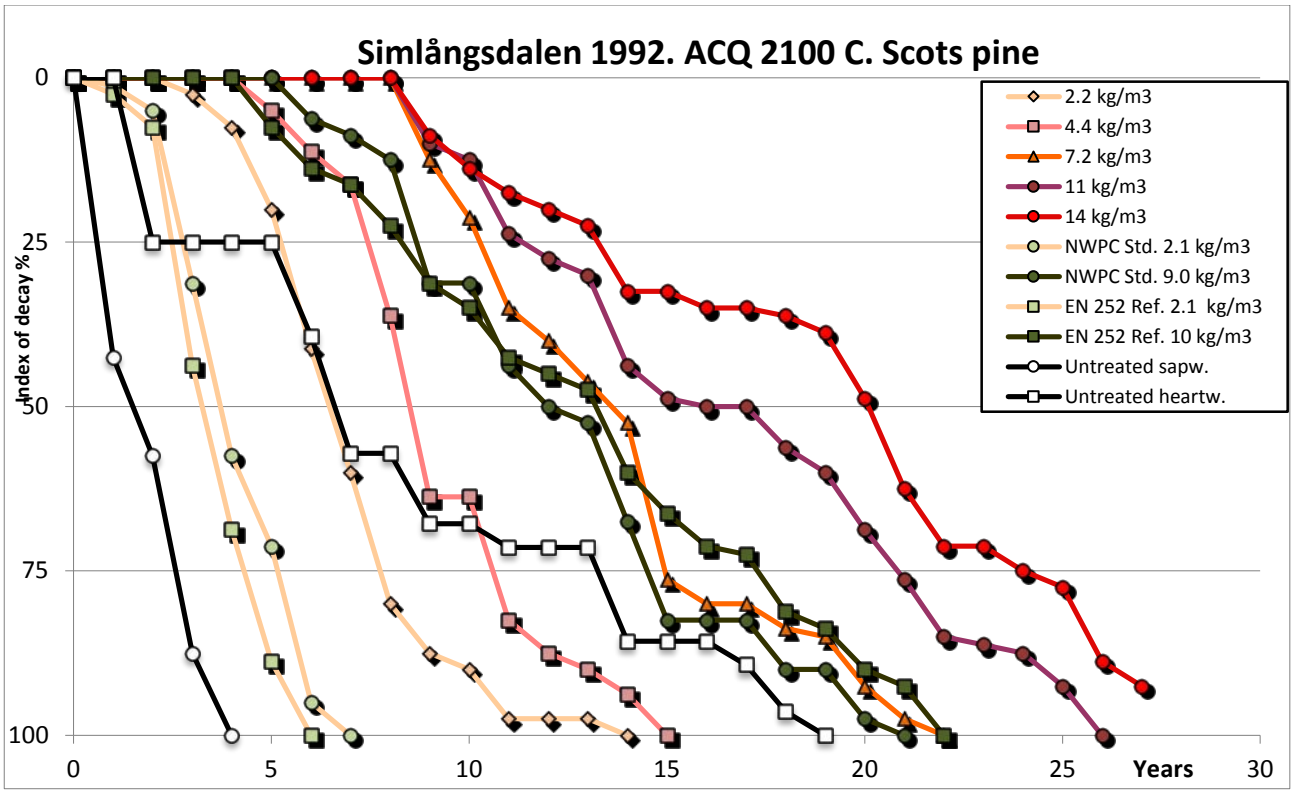


Figure 128. Field trial 1992. Index of decay for stakes of Scots pine treated with Tanalith 3485.



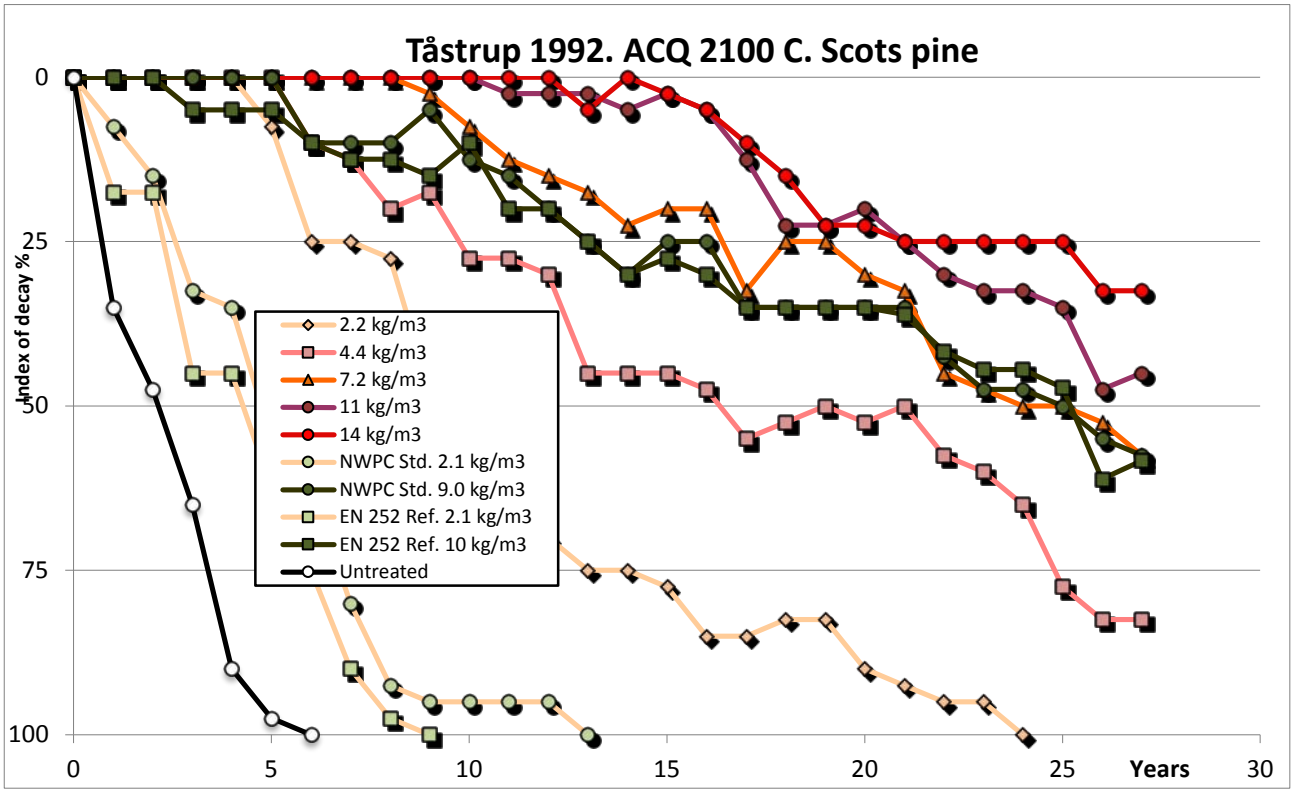
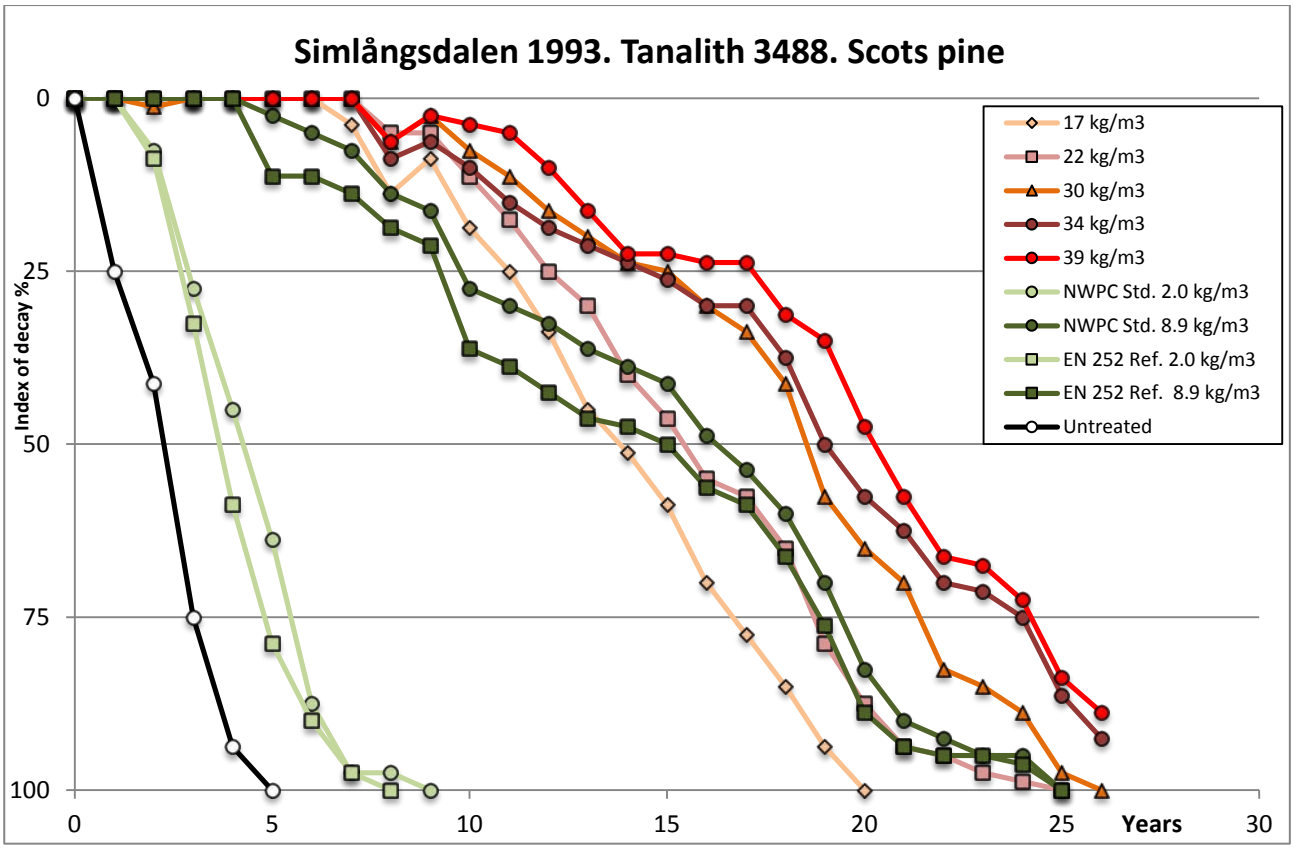


Figure 129. Field trial 1992. Index of decay for stakes of Scots pine treated with ACQ 2100 C.



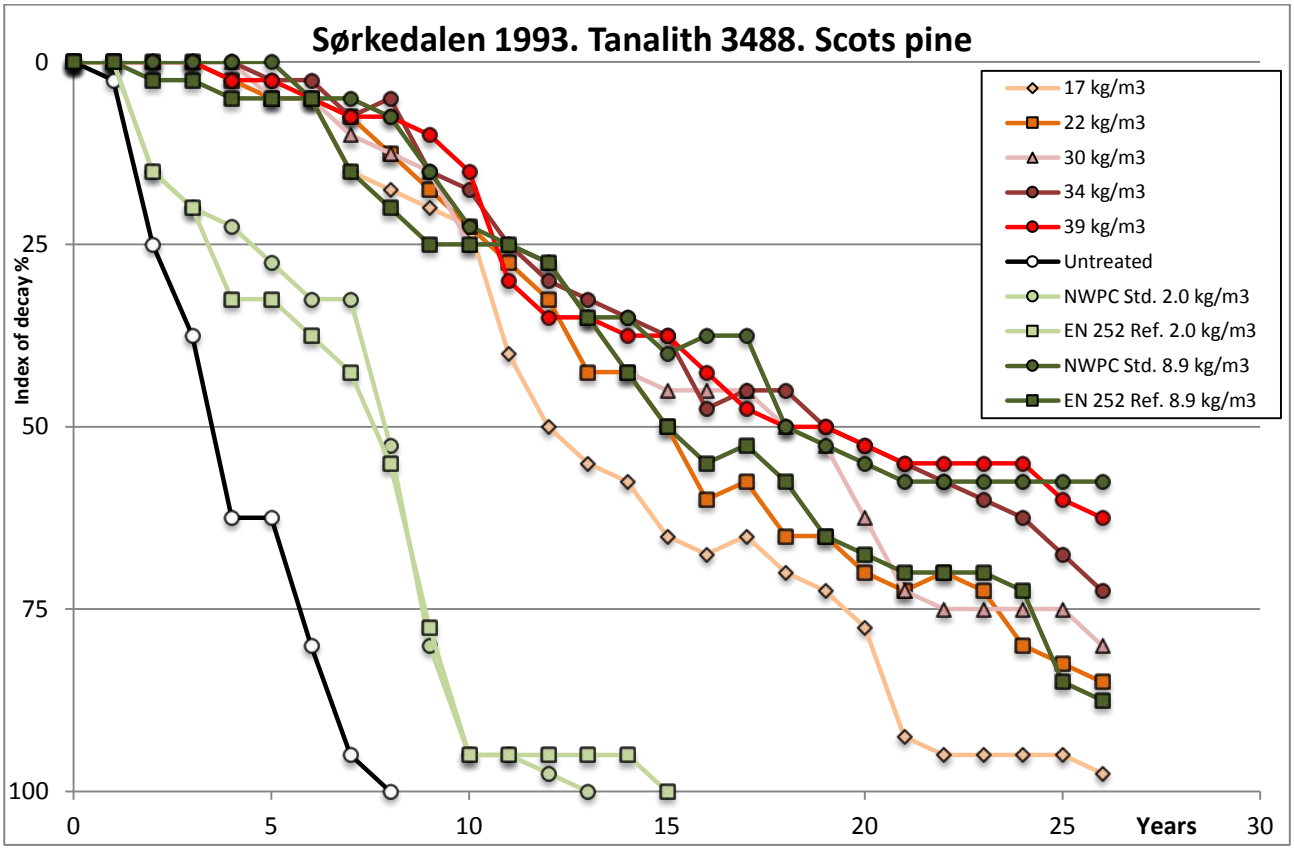
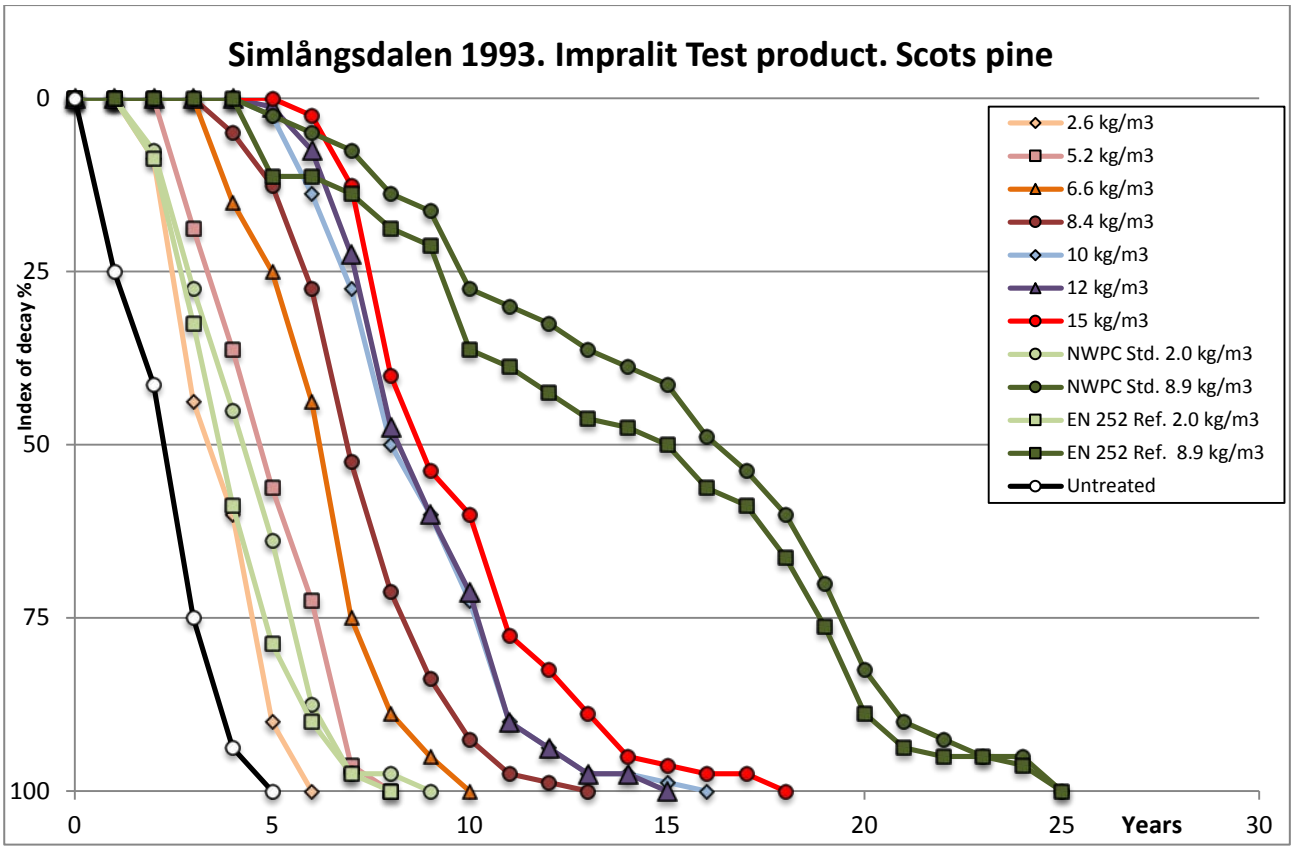


Figure 130. Field trial 1993. Index of decay for stakes of Scots pine treated with Tanalith 3488.



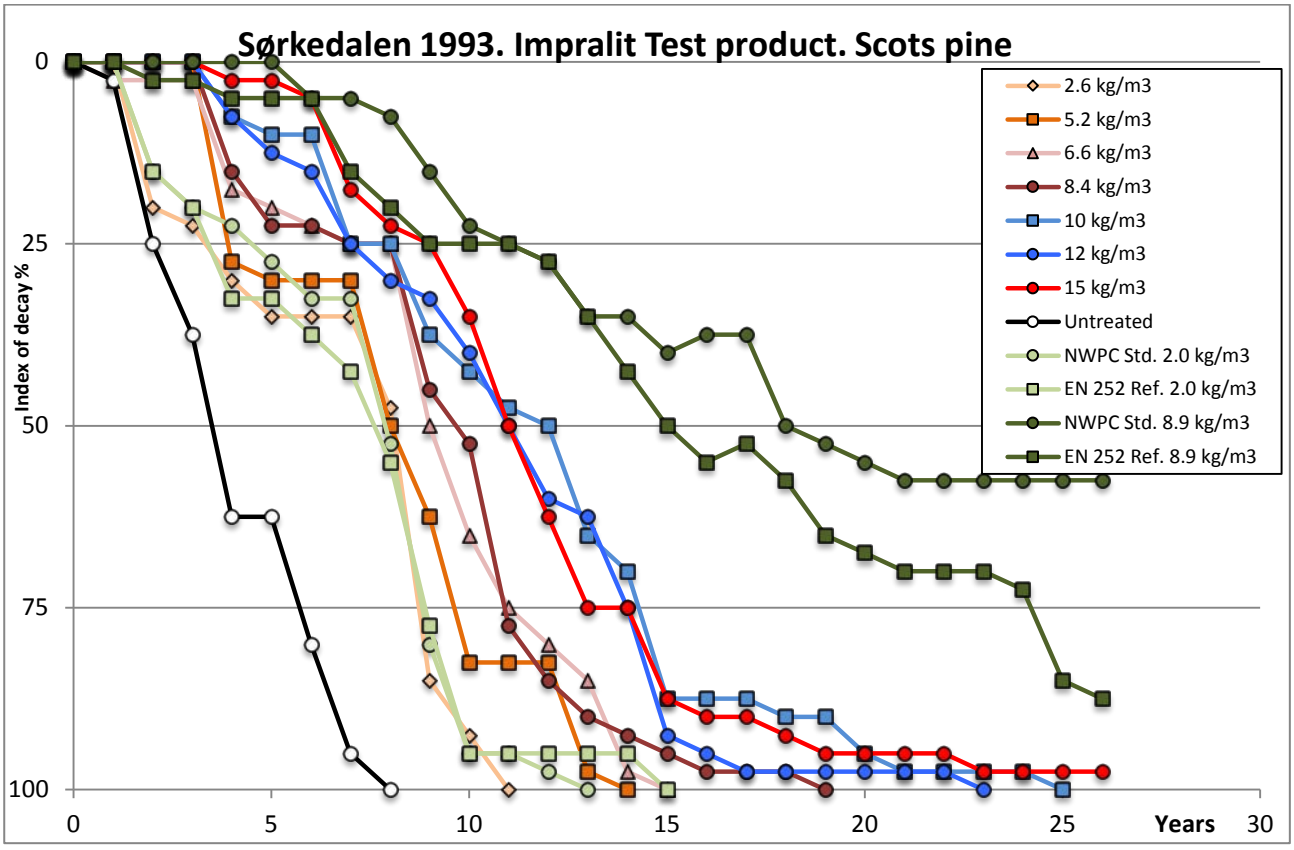
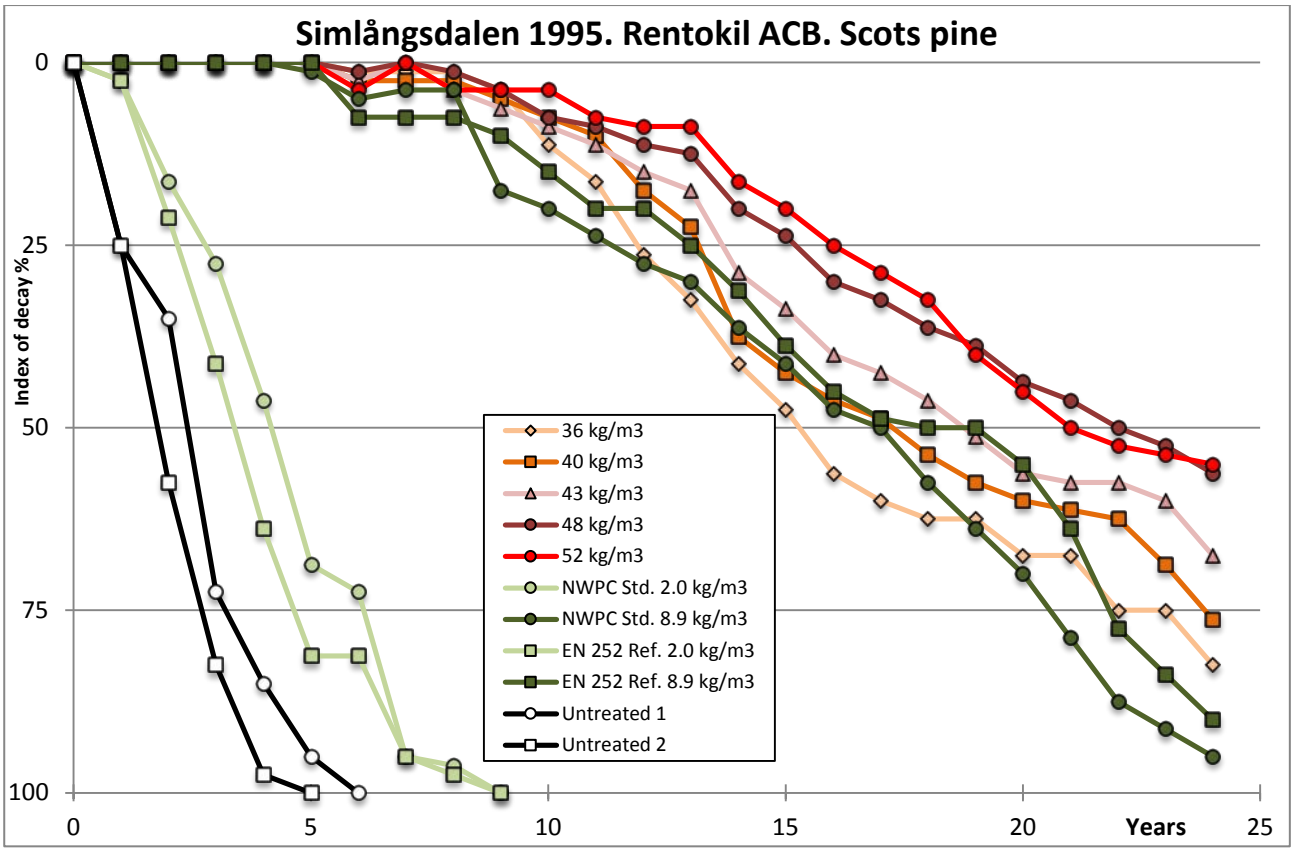


Figure 131. Field trial 1993. Index of decay for stakes of Scots pine treated with Impralit Test product.



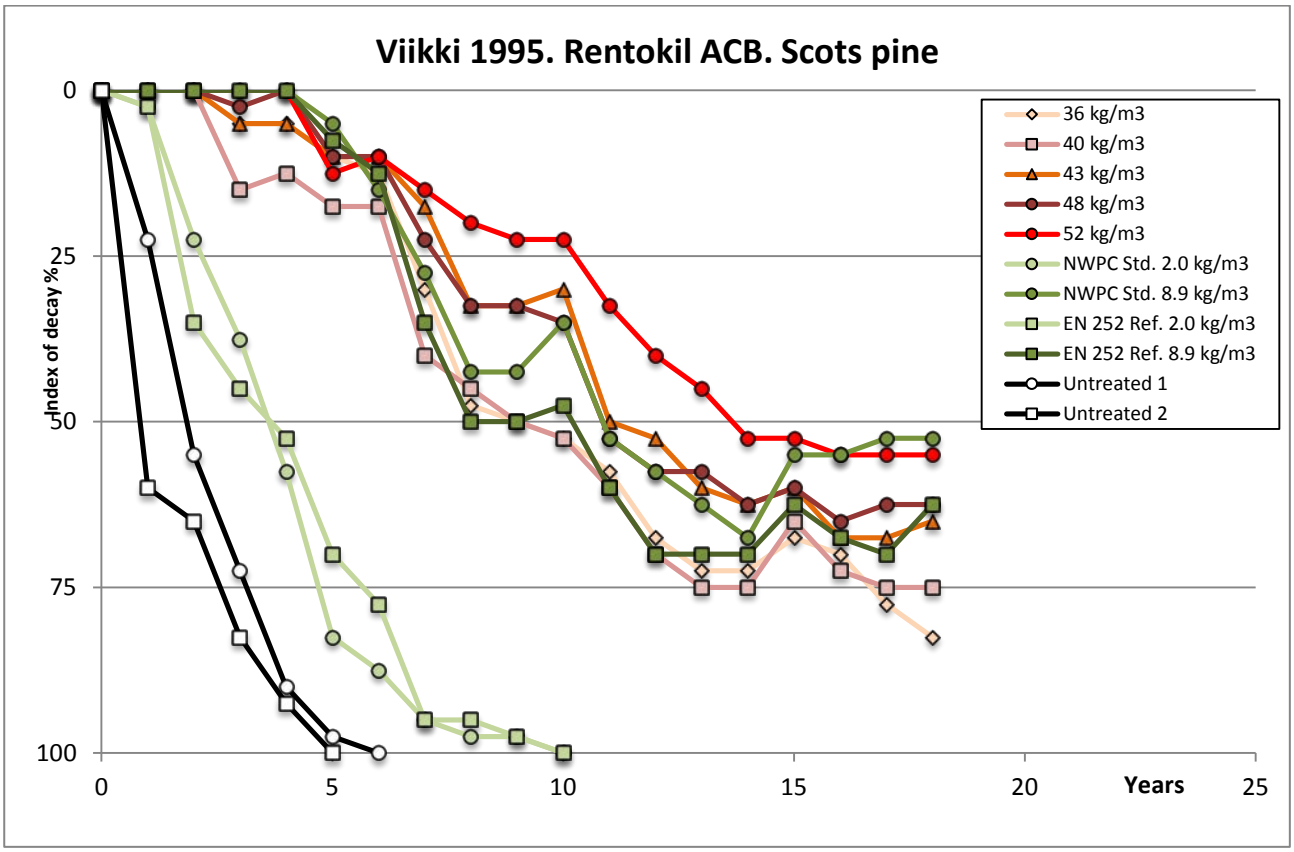
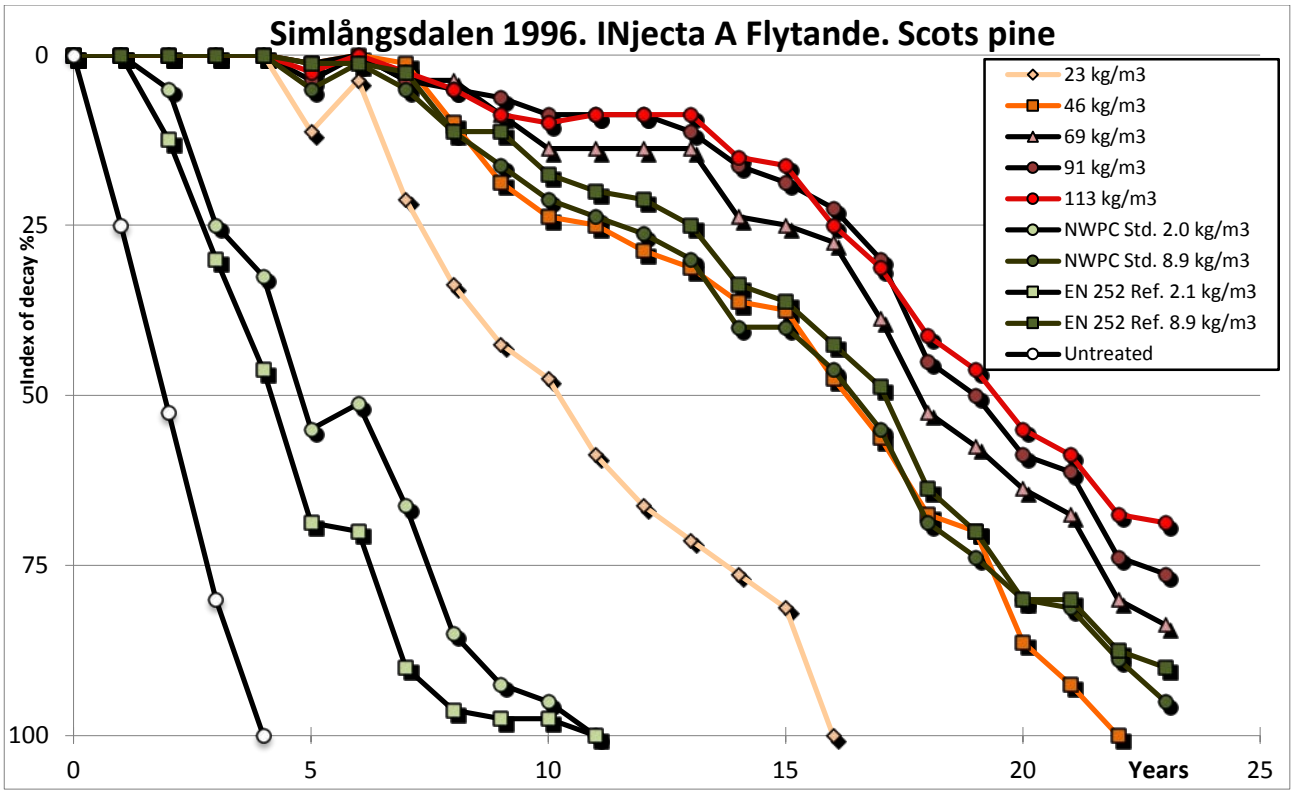


Figure 132. Field trial 1995. Index of decay for stakes of Scots pine treated with Rentokil ACB.



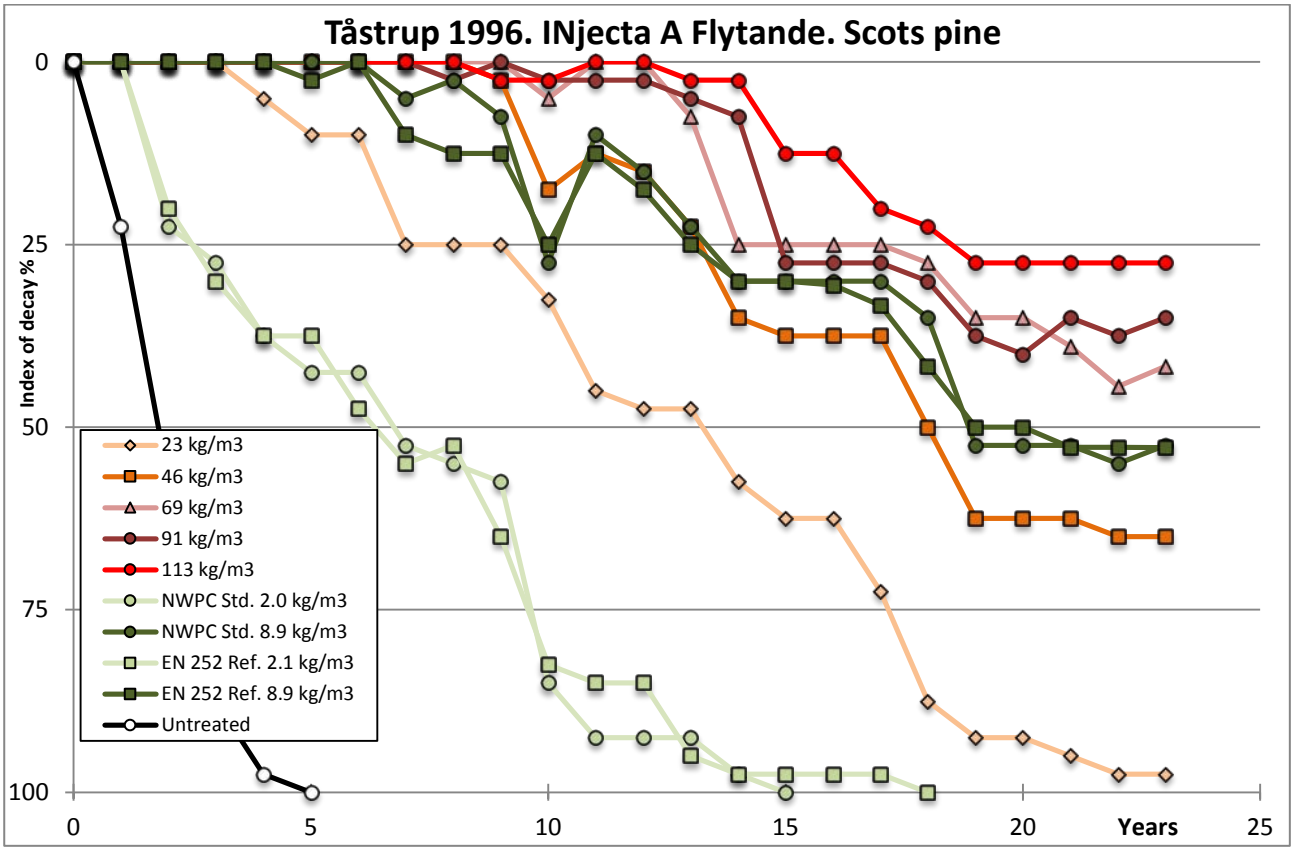
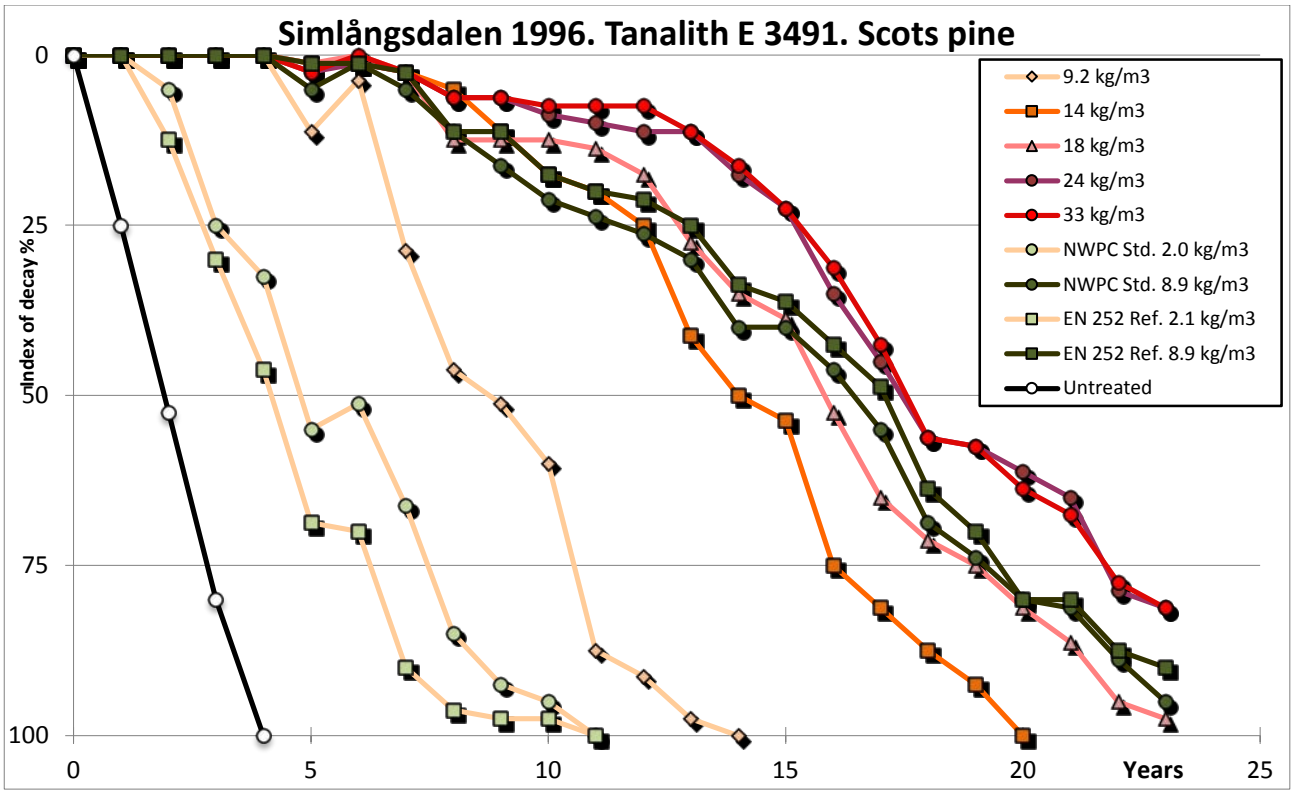


Figure 133. Field trial 1996. Index of decay for stakes of Scots pine treated with INjecta A Flytande.



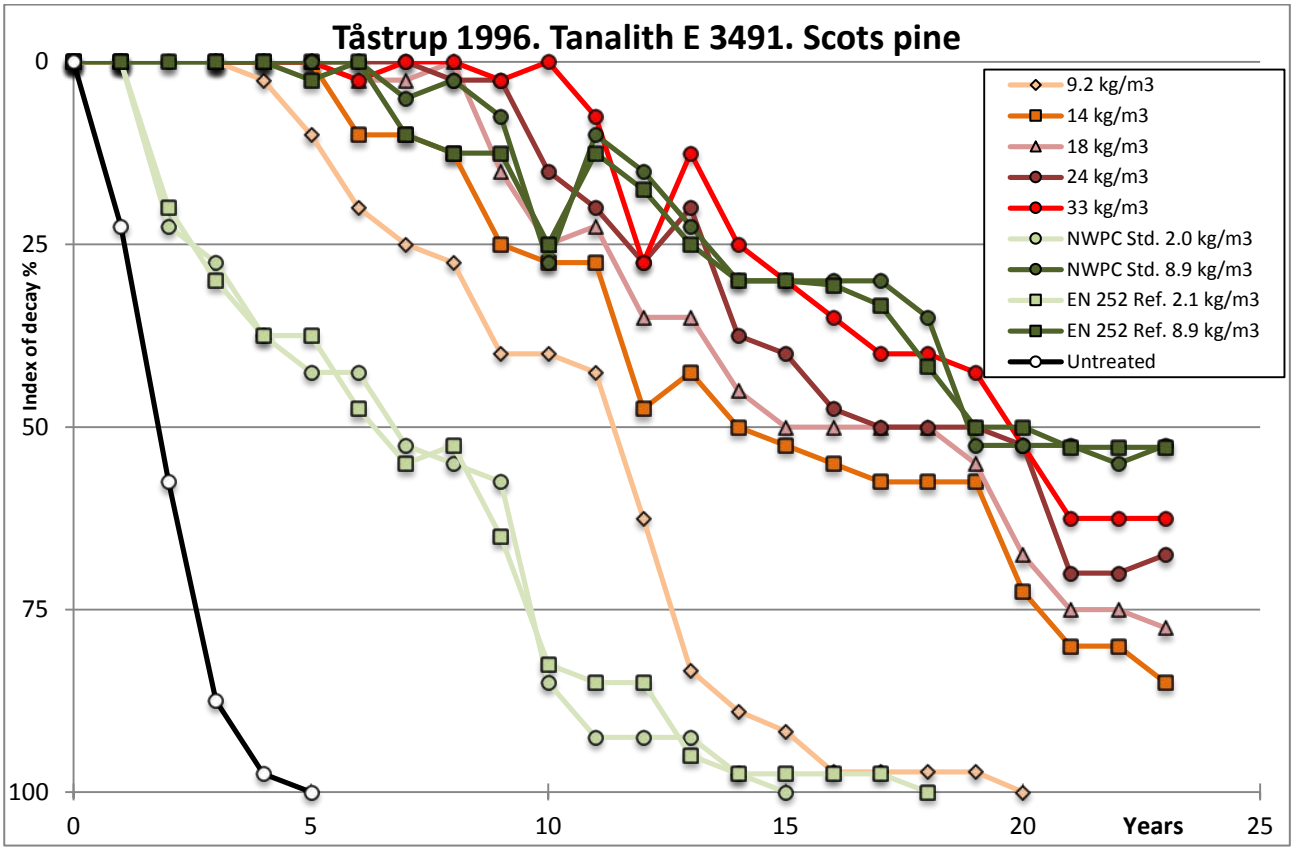


Figure 134. Field trial 1996. Index of decay for stakes of Scots pine treated with Tanalith E 3491.