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Report on the IUFRO-1982 provenance experiment on Scots pine (*Pinus sylvestris* L.)

Abstract

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The concept, history of establishment, plans of individual experimental areas and the first results on seedling height are given for the new international provenance experiment (SPIUFRO-1982) with Scots pine. The experiment includes 20 populations of *P. sylvestris* from 11 countries. Permanent experimental areas with this material have been established in Poland (2), GDR, FRG (4), Czechoslovakia, Hungary and Yugoslavia. Results of height measurements indicate that a good growth dynamics and plasticity of seedlings is to be found in the provenances from Belgium, FRG, GDR and Poland. Populations from the north of the range (Sweden, USSR) and the extreme south (Yugoslavia, Turkey) are much poorer in terms of growth compared to the remainder.

Additional key words: genotype × environment interaction, population, height growth, *Pinus sylvestris*.

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INTRODUCTION

The International Union of Forest Research Organisations twice in the past, in the years 1907, 1938 and 1939, sponsored an international experiment on Scots pine (*Pinus sylvestris* L.). The latest joint evaluation of these experiments has been published by Giertych (1979).

In 1982 the IUFRO S2.03.05 Working Party "Breeding Scots Pine" established a new, fourth in fact, international provenance experiment on *P. sylvestris*.

It is the purpose of the present paper to present the concept, a description of the experimental sites and the first results of height measurement of seedlings from this experimental series. For the majority of experimental areas their detailed plans are presented since as analyses of old provenance experiments (Giertych 1976, 1979, 1984; Giertych, Oleksyn 1981) have shown, in many instances the non-publication of this type of material has prevented many years later the finding and full utilisation of these experiments.

HISTORY OF INITIATIVE AND ESTABLISHMENT OF THE SP IUFRO-1982
PROVENANCE EXPERIMENT

At a meeting of Working Party S 2.03.05 "Breeding Scots Pine" during the XVI IUFRO Congress in June 1976 in Oslo, S. Białobok and C. Matyas have proposed that a new international provenance experiment be established on Scots pine. This proposal was accepted and S. Kocięcki from the Forest Research Institute in Warsaw was asked to prepare an instruction for seed collection and mode of establishment of experimental areas. Below is full text of the instruction as it was sent out to interested people:

A. Purpose: to establish the racial variation in the species along a longitudinal (basically along longitude 20°E) and a latitudinal (basically along latitude 52°N) gradient.

B. Pine provenances proposed for the use in the study are presented in Table 1.

Table 1

Latitudinal gradient			Longitudinal gradient		
Country	Long. E	Lat. N	Country	Long. E	Lat. N
Finland	25	66	France	7	48°15'
Finland	24	62	FRG	9	50
Sweden	17	60	FRG	10	53
Latvian SSR	24	57	GDR	14	53
Poland (Tabórz)	20	54			
Poland (Supraśl)	23	53			
Poland (Bolevice)	16	52°30'			
Poland (Spala)	18	51			
Poland (Rychtal)	18	51			
Czechoslovakia	17°30'	48°30'	Bialorussian SSR	30	52
Hungary	16°30'	47	Russian SSR	40	52
Jugoslavia	19	45			
Additionally it is proposed to include in the experiment two outlier populations:					
Spain	0	41	Turkey	35	40

C. Location of experimental areas: It is proposed to establish 10 experimental areas. Poland offers to have two of these.

It is proposed that in countries where areas are to be planted these be localised close to the seed collection site representing that country.

D. Criteria for choice of stands: The seeds should be collected in indigenous stands and thus representative for the general area, 100 years old or older, of good quality (preferably the collection should be made in a seed stand), growing on a site typical for pine at an elevation below 500 m.

E. Description of the stand: The description of the stand should be supplied together with the seed. It should include:

- geographic coordinates (long., lat., elev.)
- place name (Forest District, range, compt. no.)
- data of site (vegetation type, soil type)

— mensuration data on the stand (mean ht. and DBH, site class, vol/ha)
 — meteorological data (mean temp. and precipitation for the year and for the April to October period, length of the vegetation period).

F. Method of cone collection: It is assumed that cones will be collected from felled trees, it would however be preferable if the cones were collected from standing trees.

G. Number of trees: A provenance should be represented by a minimum of 25 trees when collected from standing trees and a minimum of 35 when collected from felled trees.

H. Criteria of tree selection: For cone collection the selected trees should have a height and diameter above the average for the stand, they should be healthy and of an even crown structure. Before cone collection or the felling of the tree a detailed description of the tree should be made containing the following parameters:

Tree no.	Age	DBH	Bark thickness	Height		Branch thickness	Notes
				total	to live crown		
1	2	3	4	5	6	7	8

ad 2 — Age as counted a core obtained with a Pressler borer at breast height.

ad 3 — Mean of the two breast height diameters measured in the N—S and E—W directions.

ad 4 — From a measurement at breast height from the southern side.

ad 5 — Measured by Blume-Leiss.

ad 6 — Measured as above from the first live branch obviously belonging to the crown.

ad 7 — Determined visually in mid length of the crown by comparison with adjacent trees:

1 — small — thinner than in adjacent trees

2 — mean — of similar thickness as average in the stand

3 — thick — thicker than in neighbouring trees of the same age.

ad 8 — Other features of the tree e.g. slightly slanting/though straight crown sparse, poorly self pruning etc.

If the collection is made from standing trees it would be advisable to mark the tree permanently by a consecutive number.

I. Treatment of cones: After collection about 1.5 to 2.0 kg of cones from each tree have to be pooled together into one lot and extracted jointly. From the cleaned seeds a sample containing 350 g and representing the given provenance together with the description of the stand (p. 5) and the trees (p. 8) and with a sanitary certificate should be sent to the Forest Research Institute in Warsaw, from where after splitting the material into smaller portions the seed will be sent out to all cooperating organisations.

J. Sowing: The seeds should be sown in a nursery having normal qualities for pine. The seed should be sown in at least three replicate lots to eliminate the micro-site differences in soil, light etc. In order to obtain as far as possible an even and high quality planting stock it is proposed to use a uniform sowing density of 100 germinable seeds per 1 m of sowing row.

K. Planting stock: It is proposed to use in all experiments a 1/1 planting stock, that is two year old material transplanted when 1 year old.

L. The experimental area: This should be located in an as far as possible even terrain in general in the region below 300 m elevation, on a site optimal for pine in the given country, on a forest clear felling (post-agricultural land not acceptable). The site preparation is to be consistent with the normal practice used in the given region for pine plantations.

M. Plot: The basic experimental unit is the plot having 121 plants (preferable in a square design 11×11 plants) at a spacing of 1.5×1.5 m. Thus each plot will have an area of 15×15 m = 225 m².

N. Blocks: Assuming that the experiment will have the provenances listed in p. 2 there will be 20 plots per block and therefore a total area of 4500 m². It is proposed that between 3 m wide gaps be left to facilitate determination of plots and work involved in thinning within them.

O. Size of the total experiment: Establishing the experiment with 4 replicates (blocks) the total area will be 18 000 m². Together with the gaps between plots and a 10 m wide belt around the whole area and assuming an optimal shape for it 29 600 m² or three hectares will be needed.

P. Plants needed: Since it is assumed that one plot will have 121 plants in the four blocks 484 plants will be needed. With a 30% reserve for beating up it is necessary to raise 630 plants per seed lot. For the whole area, assuming 20 provenances, there will be a need for 9680 plants and with the reserve for 12 800 plants.

Q. Maintenance for the experimental area: Since it is assumed that for planting the soil will be prepared in a conventional fashion (p. 12) the maintenance in the first years will depend on the cutting down of sprouts and larger weeds. With an initial spacing of 1.5×1.5 m the first thinning will be necessary not earlier than at age 10—15 years from the time of establishment.

R. Measurements and observations: It is proposed that measurements be limited to height and stem diameter only. The first measurement of these elements would occur 5 years after establishment of the experimental area and the following ones would be made every 5 years. One year after establishment of the experimental area the mortality has to be estimated per provenance and per block and in the 4th, 5th and 6th year after planting the time of flushing in the spring would have to be recorded for each provenance. Depending on the occurrence of these problems an evaluation has to be made for each provenance of attacks by needle cast disease, root rot and other fungal diseases, attacks by insect pests and damage caused by late and early frost, snow and other physical factors.

Table 2

Information on origin of seeds for the IUFRO Scots pine 1982 provenance experiment organized by Breeding Scots pine working party 82.03.05

No.	Country	Origin	Lat.	Long.	Alt.	No. of trees	Seed year	T000 seed wt.	Germinative capacity
1	SU	SP IUFRO 1982-1. Roščinskaya Dača. Roščinskij L.P.Ch. Roščinskoe Lesničestvo. Leningradskij L.Ch.P.O. comp 60,61 (Russian Soviet Fed. Soc. Rep.).	60°15'N	29°54'E	80	—	1980	5.1	83
2	SU	SP IUFRO 1982-2. Kondežskoe. Tichvinskij Leschoz Kondežskoe Lesničestvo Leningradskij Z.Ch.P.O. (Russian Soviet Fed. Soc. Rep.).	59°58'N	33°30'E	70	—	1980	5.3	72
3	SU	SP IUFRO 1982-3. Serebryanskoe. Lužskij L.P.Ch. Serebrianskoe Lesničestvo. Luga (Russian Soviet Fed. Soc. Rep.).	58°50'N	29°07'E	80	—	1980	5.6	80
4	SU	SP IUFRO 1982-4. Silene. Daugavpilsķij L.P.Ch. Lesničestvo Silene sector 655, comp. 22 (Latvian Soviet Soc. Rep.).	55°45'N	26°40'E	165	27	—	5.8	88
5	Poland	SP IUFRO 1982-5. Miłomlyn. Nadl. Miłomlyn obręb Miłomlyn. Leśnictwo Piławki comp. 39a, 84g, 84i	53°34'N	20°00'E	110	36	—	5.3	96
6	Poland	SP IUFRO 1982-6. Supraśl. Nadl. Supraśl, obręb Supraśl, Leśnictwo Krasne comp. 246d.	53°12'N	23°22'E	160	42	—	6.6	66
7	Poland	SP IUFRO 1982-7. Spala. Nadl. Spala, obręb Spala, Leśnictwo Malomierz comp. 174f.	51°37'N	20°12'E	160	38	—	6.2	93
8	Poland	SP IUFRO 1982-8. Rychtal. Nadl. Syców, obręb Rychtal, Leśnictwo Sadogóra comp. 193f.	51°08'N	17°55'E	190	35	1979/80	5.7	97
9	Poland	SP IUFRO 1982-9. Bolewice. Nadl. Bolewice, obręb Bolewice, comp. 253a.	52°24'N	16°03'E	90	25	1979/80	6.2	93
10	GDR	SP IUFRO 1982-10. Neuhaus. Staatlicher Forstwirtschaftsbetrieb Neuhaus Oberförsterei Neuhaus, Revier Wolletz comp. 18c.	53°02'N	13°54'E	40	25	1980	7.7	88
11	FRG	SP IUFRO 1982-11. Betzhorn. Forstamt Knesebeck, Försterei Betzhorn, sereal comps.	52°30'N	10°30'E	650	—	—	6.8	93
12	FRG	SP IUFRO 1982-12. Lampertheim. Forstamt Lampertheim, Försterei Lampertheim comp. 25	50°00'N	10°00'E	95—100	—	—	6.6	98
13	Belgium	SP IUFRO 1982-13. Ardenns. Region, Sud de Sambre et Meuse Ardenns, Seed plantation no. 502 Ba in Groenendaal.	50°46'N	4°26'E	110	25 trees	1978/79	9.0	94
14	France	SP IUFRO 1982-14. Hagenau. Forst de Hagenau, Alsace, Plain.	48°49'N	7°46'E	130—180	35	1979/80	6.6	97
15	Sweden	SP IUFRO 1982-15. Sumpberget. Hedemora District Owner, Stora Kopparberg Bergvik, Ludvika Forest District.	60°11'N	15°52'E	185	36	1979	4.4	99
16	Czechoslovakia	SP IUFRO 1982-16. Zahorie.	48°46'N	17°03'E	160	—	—	—	81
17	Hungary	SP IUFRO 1982-17. Pornópáti. 13/A Seedstand no. 262.	47°20'N	16°28'E	—	16	—	8.2	92
18	Yugoslavia	SP IUFRO 1982-18. Maočnica. Crna Gora, Pljevlja.	43°10'N	19°30'E	1200	—	1979	6.6	89
19	Yugoslavia	SP IUFRO 1982-19. Prusačka Rijeka. Bosnia and Hercegovina, Banja Luka, Section 70.	44°06'N	17°21'E	800—970	—	1979	7.1	91
20	Turkey	SP IUFRO 1982-20. Catacik. Forest district Eskischir-Çatacik, Compt. No. 44.	40°00'N	31°10'E	1380—1420	28	—	9.0	91

S. Exchange of information: It is proposed that each of the cooperators should send his data on measurements and observations to Poland from where he will receive a compilation of all the data obtained on all the areas. Immediately after establishment of the experimental areas each participant should supply the coordinator with data on the sowings (number of 1/0 and 1/1 plants obtained), quality of the planting stock and data on the localisation of comparative areas (as in p. 5), arrangement of plots and distribution of provenances. In the following years participants would supply the coordinator with the results of periodic measurements and other observations such as phenological factors and the response to adverse biotic and abiotic factors”.

Following on that proposed outline of the study prof. S. Białobok began in 1978 to gather from the selected locations an adequate quantity of seeds. In the letters he sent out he asked that the collections be made in the winter 1978/1979. In all by 1981 seeds were collected from 20 provenances in 11 countries (Table 2, Fig. 1). Unfortunately it proved impossible to obtain seeds from all the planned populations. Lacking were seeds from Finland (two provenances were planned),

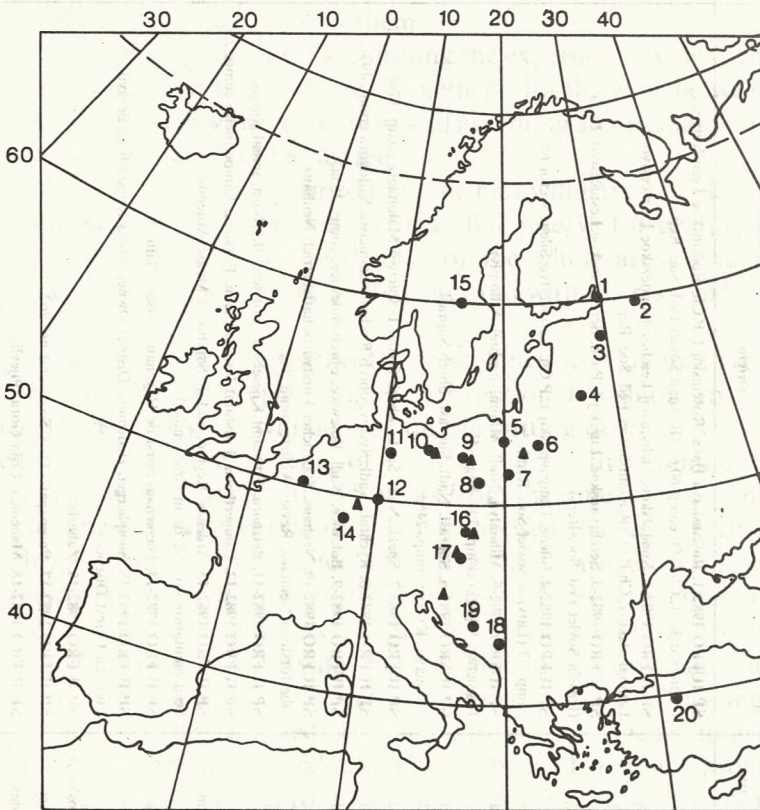


Fig. 1. Seed origin of the provenances (circles) and location of the planting sites (triangles) for the SP IUFRO-1982 experiment

Spain and the Białorusian SSR. On the other hand included in the experiment is a greater number of provenances from the Russian FSSR (3) and from Yugoslavia (2) as well as an initially not planned provenance from Belgium. Seeds for the experiment were supplied by: J. Gračan (Yugoslavia), Y. Birot and M. Aubert (France), I. Ievin and D. Pirags (Latvian SSR), A. Schneck (GDR), H. Otto (FRG), A. Persson (Sweden), A. Nanson (Belgium), C. Matyas (Hungary), M. Boydak (Turkey), S. Kocięcki and S. Białobok (Poland), A. Laffers (Czechoslovakia) and G. I. Ryedko (Russian FSSR).

As can be seen from the data presented in Table 2 the seeds have been collected only partially in accordance with the recommended method. The suggested time for seed collection (1978/1979 winter) happened to be a period of poor cone crop, thus only for the seeds from Belgium (nr. SP IUFRO-1982-13) was it possible to meet the requested timing.

Not in all cases did the organisers of the experiment receive sufficient information together with the seed lots that would characterise fully the maternal stands (Table 2). The seeds of provenance Roščinskaya Dača, Kondežskoe and Serebryanskoe (USSR) originated from a commercial seed extraction plant and have not been collected specially for the needs of the experiment following the instructions supplied. In the case of 4 provenances (Table 2) seeds have been collected from locations above 500 m elevation. Also it was not possible to accumulate for all provenances sufficient data concerning the climatic conditions under which the stands grew (Table 3).

Table 3

Compilation of climatic data for maternal stands of the SP IUFRO-1982 provenance experiment

Provenance	Mean annual temp. °C	Mean temp. for months IV—X °C	Annual precipitation mm	Precipitation for months IV—X mm	Length of veg. season in days
1*	3,4		445		101
2*	3,7		470		120
3*	5,0		616		117
4	5,4		619	451	138
5	7,1		598	402	
6	7,0	12,5	617	406	210
7	7,4	13,4	575	406	210
8	7,1	12,8	715	482	
9	7,8	13,7	556	366	
10	8,2		551	367	
11	8,1	14,6	650	299	143
12	9,6	16,5	645	372	170
13*	9,2		816		
14	10,0		850		
15	4,5	10,1		395	167
16	10,0		550		
17	9,6				
18*	7,4		1018		
19*	9,6		852		
20	6,5	12,5	878	382	

* Walter, Leith (1958)

For reasons independent of the organisers, 15—27 g samples of the seeds were sent out to the individual participants rather late, in early March 1982 and not as initially planned in December 1981. They were sent to the following people: D. Pirags (Latvian Research Institute of Forestry Problems, Riga, USSR); Central Research Institute of Forest Genetics (TsNILGIS), Voronezh, USSR; G. Melchior (Institut für Forstgenetik und Forstpflanzenzucht, Grosshansdorf, FRG); J. Kleinschmit (Niedersächsische Forstliche Versuchsanstalt, Escherode, FRG); G. Bolland (Institut für Forstwissenschaften, Eberswalde, GDR); A. Laffers (Forest Research Institute, Zvolen, Czechoslovakia); C. Matyas (Forest Research Institute, Arboretum Kamon, Szombathely, Hungary); J. Gračan (Forest Research Institute, Jastrebarsko, Yugoslavia); V. Enescu (Institutul de Cercetari si Amanajari Silvice I.C.A.S., Bucharest, Romania); Y. Birot (I.N.R.A., Centre de Recherches Forestiers, Olivet, France); S. Kocięcki (Forest Research Institute, Warsaw, Poland); M. Giertych (Institute of Dendrology, Kórnik, Poland).

DESCRIPTION OF THE PERMANENT EXPERIMENTAL AREAS

Till mid 1987 the organisers have obtained information on 7 of the permanent experimental plots established for the SP IUFRO-1982 experiment (Fig. 1). Description of the areas is given below.

THE EXPERIMENTAL AREA IN WYSZKÓW (POLAND)*

Sowing: 28—29 April 1982 in the nursery of the Department of Seed Science and Selection of the Forest Research Institute. The seeds were sown under glass on a medium composed of garden peat with mineral soil. Seeds of each origin were sown in 3 replicates. After one year the seedlings were transplanted. Establishment of the field trial: 10—13 April 1984.

Experimental area:

Forest District Wyszków, Sub-District Leszczydół, Range Prządzie, Compt. 30b. The previous pine stand was removed in winter 1982/1983 and during the summer of 1983 the soil was prepared by plowing furrows.

Elevation: 112 m

Latitude: 52°41' N

Longitude: 21°28' E

Lay-out:

4 replications. 22 provenances. 110 plants/plot. Spacing 1.5 × 1.8 m. Total area 3.15 ha. Additionally to SP IUFRO-1982 provenances two further provenances were included in the trial from Poland (Wyszków — no. 21 and Syców — no. 22, both in 2 replicates). See Fig. 2.

* According to information supplied by S. Kocięcki and his publication (Kocięcki 1985).

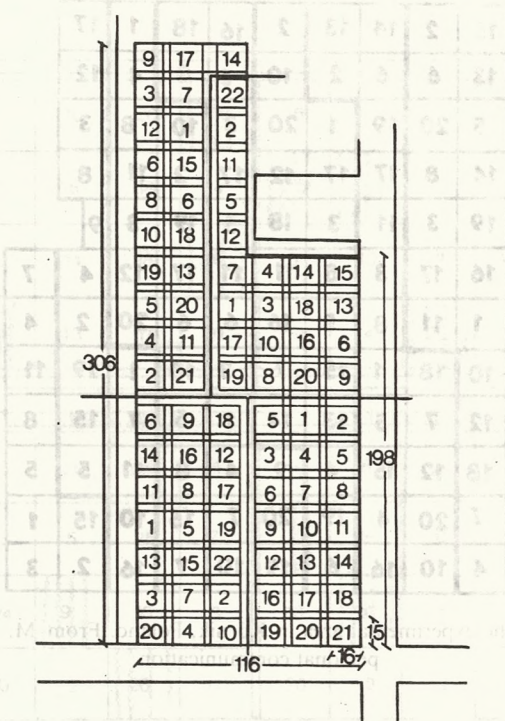


Fig. 2. Lay-out of the experimental area in Wyszaków, Poland. From S. Kocięcki, personal communication

THE EXPERIMENTAL AREA IN KÓRNIK (POLAND)*

Experimental area:

Two year seedlings were obtained from the Forest Research Institute in April 1984.

Forest District: Kórnik, Range: Zwierzyniec, Compt. 91. Previous stand of poplars removed during winter 1983/1984. Full plowing between poplar stumps!

Elevation: 70 m

Latitude: 52°15' N

Longitude: 17°04' E

Data of climate: Average annual precipitation: 526 mm. Average annual temperature: 7.7°C

Lay-out:

Seven blocks. Provenance 9 is only in block VI with $2 \times 12 = 24$ seedlings planted. The other provenances have from 3 to 8 replicate plots. Spacing 1.5×0.5 m. Plot size 6×6 m, with 4 rows \times 12 plants = 48 plants per plot. See Fig. 3.

* According to information supplied by M. Giertych.

15	2	14	13	2	16	18	1	17	
13	6	6	2	10	5	8	4	12	
5	20	19	1	20	3	10	8	3	
14	8	17	17	12	17	2	11	8	
19	3	11	3	18	5	19	3	9	
16	17	3	8	11	11	17	12	4	7
1	11	8	5	16	6	6	20	2	4
10	18	1	15	7	2	10	1	19	11
12	7	5	13	14	1	5	7	15	8
18	12	15	4	2	4	8	11	5	5
7	20	4	19	20	7	15	10	15	1
4	10	16	6	19	10	7	16	2	3

Fig. 3. Lay-out of the experimental area in Kórnik, Poland. From M. Giertych 1984, personal communication

EXPERIMENTAL AREA IN BENSHEIM (FRG)*

Sowing: 16—17 May 1983 in the nursery of the Federal Research Institute of Forest Genetics and Forest Tree Breeding in Grosshansdorf.

Potted: September 1983 (containers 8 × 8 cm).

Transplanting in the field (Grosshansdorf): May 1985

Establishment of the field trial: 1—3 April 1986

Internal number: Ki 56

Experimental area:

Hessen, Forstamt Bensheim, Gemarkung Klein-Hausen Fl. 10 Nr 7, Abteilung 187/188

Elevation: 92—96 m

Latitude: 49°39' N

Longitude: 8°31' E

Data of climate: Average annual precipitation — 609 mm (313 mm during the vegetation period from May to September. Annual average temperature: 9.5°C (16.2°C during the vegetation period from May to September).

Soil: Sand of the brown-soil-gley type.

Preparation of the trial area: ploughing and harrowing the soil — 'Gamma — Streunex' against the grubs of the cockchafer (*Melolontha melolontha*).

* According to information supplied by B. R. Stephan.

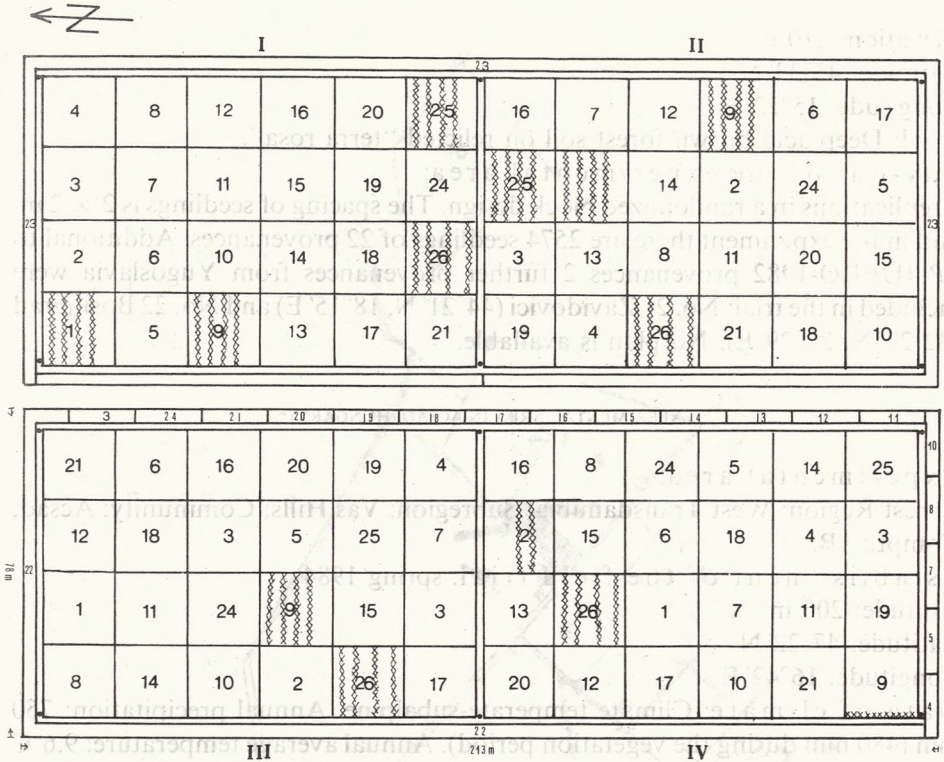


Fig. 4. Lay-out of the experimental area in Bensheim, FRG. From B. R. Stephan 1985, personal communication

Lay-out of the experimental area:

4 replications. 24 provenances + 2 in the edge rows. 121 plants/plot (design 11 × 11 plants). Spacing of 1.5 × 1.5 m, 3 m wide gaps between the replications. Total area of 3.3228 ha. Additional to SP IUFRO-1982 provenances 6 further provenances from Belgium, China and FRG were included in the trial and in the edge rows No. 26 is a FRG standard. See Fig. 4.

EXPERIMENTAL AREA IN DRENOVAC (YUGOSLAVIA)*

Sowing: 4 may, 1982. The seedlings have been raised in nursery up to Spring 1985.

Establishment of the field trial: 26—30 April, 1985.

Experimental area:

Locality Drenovac, Forest enterprise Karlovac, Forest office Duga Resa.

* According to data from a paper by J. Gracan "International provenance test of Scots pine (*Pinus sylvestris* L.)" given at a symposium: "Genetic Effects of Air Pollutants in Forest Tree Populations". IUFRO-Joint Meeting 3—7 August, 1987, Grosshansdorf, FRG.

Elevation: 210 m

Latitude: 45°33' N

Longitude: 15°22' E

Soil: Deep acid brown forest soil on relicted "terra rosa".

Lay-out of the experimental area:

4 replications in a randomized block design. The spacing of seedlings is 2 × 2 m, and in the experiment there are 2574 seedlings of 22 provenances. Additional to SP IUFRO-1982 provenances 2 further provenances from Yugoslavia were included in the trial: No. 21 Zavidovici (44°21' N, 18°15' E) and No. 22 Bosiljgrad (42°29' N, 22°29' E). No plan is available.

EXPERIMENTAL AREA IN ACSAD (HUNGARY)*

Experimental area:

Forest Region: West Transdanubia; Subregion: Vas Hills; Community: Acsad; Compt.: 1B.

Establishment of the field trial: spring 1984

Altitude: 200 m

Latitude: 47°22' N

Longitude: 16°42' E

Data of climate: Climate temperate-subalpine. Annual precipitation: 750 mm (480 mm during the vegetation period). Annual average temperature: 9.6°C January: -0.9°C; July: 19.8°C). Air humidity in July: 58% (at 2.00 p.m.).

Soil: lessivated brown forest soil, depth more than 1.00 m.

Hydrology: mesophilous site.

Lay-out of the experimental area: see Fig. 5 and 6.

Forest company in charge: West Hungarian Timber Co., Szombathely.

Individual provenances in the trial were given new numbers:

SP IUFRO-1982 — 1. Roščinskaya Dača = 587/82

SP IUFRO-1982 — 2. Kondežskoe = 588/82

SP IUFRO-1982 — 3. Serebryanskoe = 589/82

SP IUFRO-1982 — 4. Silene = 590/82

SP IUFRO-1982 — 5. Miłomłyn = 591/82

SP IUFRO-1982 — 6. Supraśl = 592/82

SP IUFRO-1982 — 7. Spała = 593/82

SP IUFRO-1982 — 8. Rychtal = 594/82

SP IUFRO-1982 — 9. Bolewice = 595/82

SP IUFRO-1982 — 10. Neuhaus = 596/82

SP IUFRO-1982 — 11. Betzhorn = 597/82

SP IUFRO-1982 — 12. Lampertheim = 598/82

SP IUFRO-1982 — 13. Ardenns = 487/80

SP IUFRO-1982 — 14. Haguenau = 600/82

* According to information supplied by L. Harkai and C. Matyas.

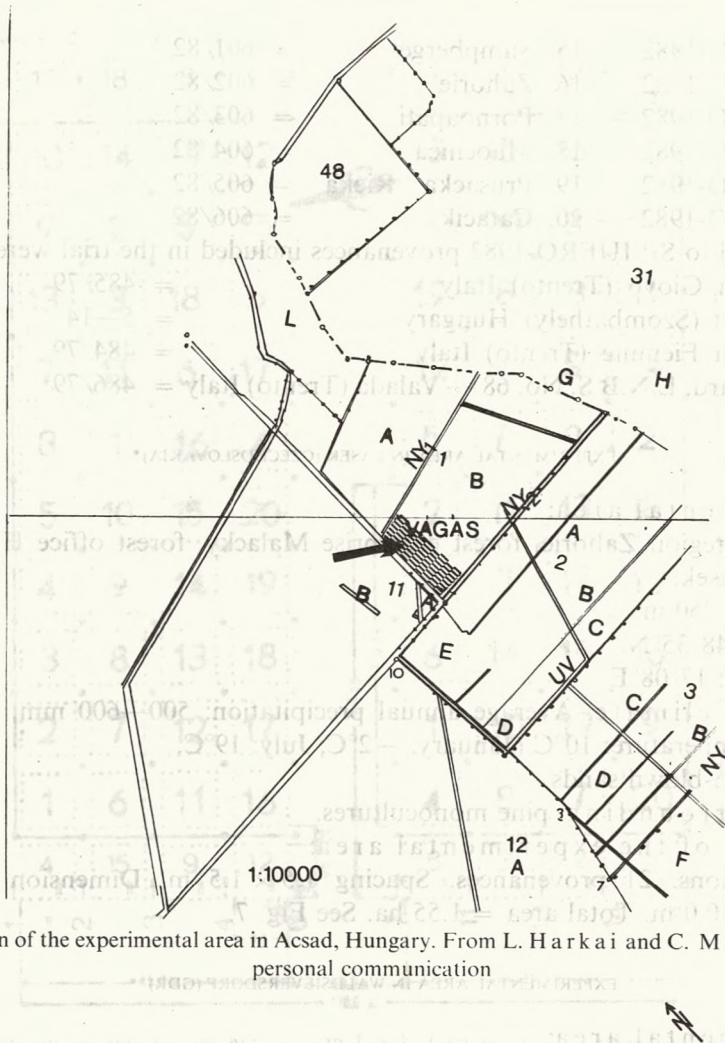


Fig. 5. Plan of the experimental area in Acsad, Hungary. From L. Harkai and C. Matyas 1985, personal communication

605/82	595/82	600/82	606/82
592/82 602/82	601/82 602/82	593/82 485/79	597/82 599/82
487/80 5-14	594/82 603/82	602/82 599/82	5-14 595/82
594/82 604/82	484/79 605/82	587/82 605/82	605/82 598/82
590/82 589/82	596/82 606/82	5-14 486/79	600/82 487/80
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599/82 600/82	589/82 486/79	603/82 484/79	592/82 602/82
596/82 587/82	591/82 590/82	590/82 589/82	486/79 587/82
591/82 486/79	592/82 604/82	606/82 595/82	593/82 589/82
603/82 598/82	600/82 487/80	598/82 588/82	588/82 590/82
588/82 595/82	597/82 599/82	592/82 487/80	594/82 596/82

Fig. 6. Lay-out of the experimental area in Acsad, Hungary. From L. Harkai and C. Matyas 1985, personal communication

SP IUFRO-1982 — 15. Sumpberget	= 601/82
SP IUFRO-1982 — 16. Zahorie	= 602/82
SP IUFRO-1982 — 17. Pernoapati	= 603/82
SP IUFRO-1982 — 18. Maocnica	= 604/82
SP IUFRO-1982 — 19. Prusacka Rieka	= 605/82
SP IUFRO-1982 — 20. Catacik	= 606/82

Additional to SP IUFRO-1982 provenances included in the trial were:

Comme di Giovo (Trento) Italy	= 485/79
Pernoapati (Szombathely) Hungary	= 5—14
Castello di Fiemme (Trento) Italy	= 484/79
Seed orchard, L.N.B.S. No. 68 — Valada (Trento) Italy	= 486/79

EXPERIMENTAL AREA IN LASEK (CZECHOSLOVAKIA)*

Experimental area:

Slovakia, region Zahorie, forest enterprise Malacky, forest office Hrabovec, locality Lasek.

Elevation: 250 m

Latitude: 48°35'N

Longitude: 17°08'E

Data of climate: Average annual precipitation: 500—600 mm. Average annual temperature: 10°C (January: -2°C; July: 19°C).

Soil: wind-blown sands.

Area surrounding: pine monocultures.

Lay-out of the experimental area:

4 replications. 21 provenances. Spacing 1.5 × 1.5 m. Dimension of area 141.0 × 110.0 m. Total area = 1.55 ha. See Fig. 7.

EXPERIMENTAL AREA IN WALDSIEVERS DORF (GDR)**

Experimental area:

StFB Strausberg, Rev. Waldsieversdorf, abt. 6113 a³.

Elevation: 50 m

Latitude: 52°33'N

Longitude: 14°05'E

Data of climate: Average annual precipitation (1901—1950): 533 mm (April—September: 314 mm; May—August: 234 mm). Average annual temperature (1901—1950): 8.2°C (January: -1.2°C; July: 18.2°C; May—August: 16.1°C).

Soil: sandy, brown of type „Nedlitz”.

Lay-out of the experimental area:

4 replications. 20 provenances. 121 plants/plots. Spacing 1.5 × 1.5 m. See Fig. 8.

* According to information supplied by A. Laffers.

** According to information supplied by G. Bolland.

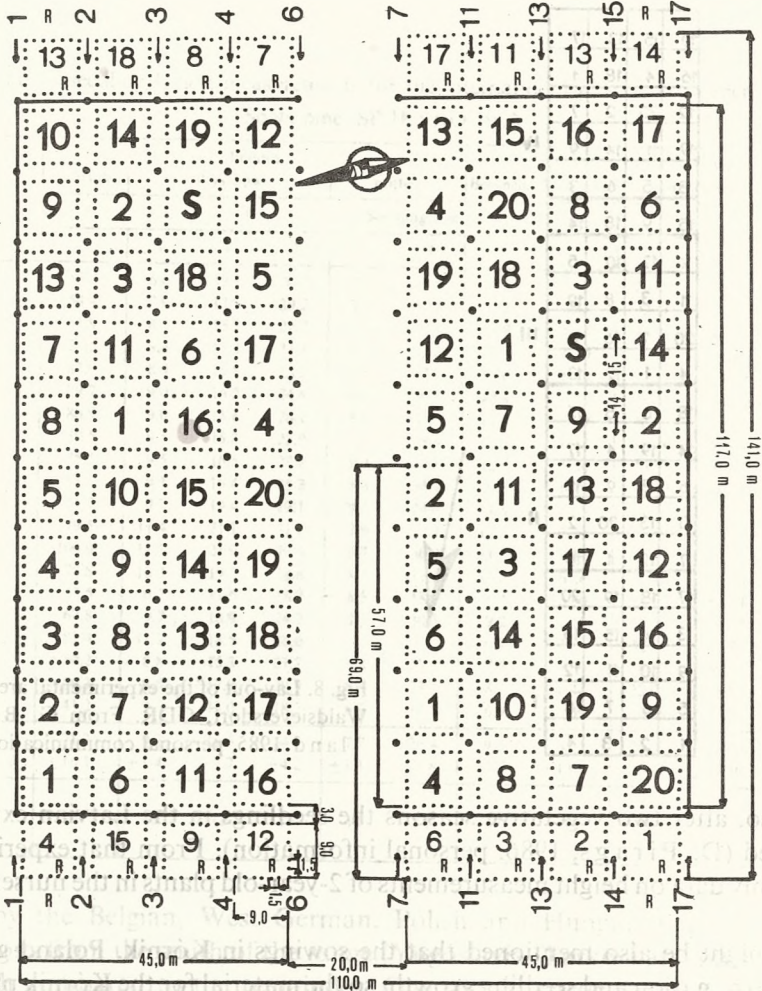


Fig. 7. Lay-out of the experimental area in Lasek, Czechoslovakia. From A. Laffers 1985, personal communication

Appart from the experimental areas described above three further ones were established in the Federal Republic of Germany by the Niedersächsische Forstliche Versuchsanstalt in Escherode (J. Kleinschmidt 1985, personal information). Besides the 20 provenances from the SP IUFRO-1982 series there are also included 50 other populations of Scots pine from the Federal Republic. Unfortunately until now we do not have any data on the localisation of these areas nor their descriptions.

According to the information supplied by V. Enescu (1984, personal information) the seeds sown in Romania, both in the nursery and in the greenhouse did not germinate. It is difficult to tell what the reason was, since all the seeds were used for the sowing and therefore later it was not possible to test the seeds for germinability.

10	15	13	17
16	4	18	1
12	20	2	7
19	11	14	9
8	5	6	3
15	9	18	14
2	17	10	5
11	3	8	19
20	7	16	6
4	1	12	13
18	6	5	15
14	19	4	17
6	8	9	11
3	13	20	2
7	12	1	10
17	18	19	20
13	14	15	16
9	10	11	12
5	6	7	8
1	2	3	4

IV

III

II

I



Fig. 8. Lay-out of the experimental area in Waldsieversdorf, GDR. From G. Boland 1985, personal communication

Also, after two vegetative seasons the seedlings in the Latvian experiment perished (D. Pirags, 1986, personal information). From that experiment we have only data on height measurements of 2-year-old plants in the nursery (Table 4).

It might be also mentioned that the sowings in Kórnik, Poland gave very poor germination and seedling growth, so the material for the Kórnik plantation was taken from that raised by the Forest Research Institute in Warsaw.

From Olivet, France we have obtained information that there are no plans to establish this experiment in France (B. Roman-Amat, 1984, personal information).

Of institutions to which in 1982 seed samples were sent we have no information as yet only from the Central Research Institute of Forest Genetics in Voronezh (USSR).

SEEDLING GROWTH IN HEIGHT

Several participants of the experiment have supplied us with the first results of the measurements of seedlings (Table 4). These are both measurements made in nurseries and on the permanent locations. From the measurements presented in Table 4 it appears that the best growth and adaptability has been demon-

Table 4
 Compilation of seedling height measurements for the international provenance experiment with
 Scots pine, SP IUFRO-1982

Provenance	Poland				FRG		Yugoslavia		USSR		
	Kórnik	Wyszaków		potted		Bensheim Escherode		Drenovac		nursery	
	Seedling age in years										
	5	1	2	3	1	3	2	1	3	5	2
1	55.3	6.6	12.5	20.7	7.9	—	6.3	4.73	20.62	36.20	13.3
2	54.4	7.0	13.9	20.2	7.3	13.8	7.2	4.86	22.86	47.08	16.9
3	61.9	8.7	15.7	22.2	—	—	8.9	5.26	24.21	45.91	16.9
4	72.5	8.4	15.4	23.6	6.5	22.8	7.3	6.50	26.64	50.40	14.5
5	87.9	8.9	15.8	25.2	6.9	27.5	10.0	6.19	28.67	59.29	15.5
6	79.7	9.0	16.2	24.8	6.4	30.4	10.4	6.54	28.25	58.01	15.4
7	80.9	9.0	15.6	26.2	8.6	35.7	11.3	6.59	30.37	55.65	15.1
8	89.5	9.5	15.8	28.0	7.3	28.4	9.9	6.14	31.36	56.64	14.3
9	75.5	9.5	16.5	27.2	9.4	29.9	12.2	5.34	30.56	62.06	—
10	81.7	9.1	16.4	28.3	8.3	30.1	9.2	6.20	30.67	56.18	15.6
11	75.7	9.7	19.4	29.1	9.2	24.0	11.8	6.69	31.66	61.32	17.6
12	79.5	11.4	21.1	31.6	7.9	29.4	14.3	7.33	41.51	74.02	15.6
13	100.9	11.1	21.9	29.6	9.7	30.4	11.8	8.11	38.91	68.75	15.6
14	78.8	10.3	19.2	28.8	8.3	31.2	11.5	6.86	34.16	59.50	15.8
15	53.5	6.2	11.5	16.3	6.5	18.1	5.4	3.80	34.97	59.14	12.3
16	67.8	9.7	18.9	24.2	8.3	30.3	9.2	7.19	30.10	51.37	14.3
17	87.4	11.7	18.5	28.0	—	—	10.7	7.36	32.61	54.75	16.5
18	50.2	8.8	15.3	21.7	5.8	27.3	7.5	5.99	26.67	48.36	14.2
19	50.3	9.8	17.9	20.9	8.4	23.1	8.7	6.44	22.05	35.62	13.2
20	41.2	9.3	13.0	18.2	6.7	17.1	6.9	6.09	24.49	37.72	11.6
\bar{x}	71.2	9.2	16.5	24.7	7.7	26.4	9.5	6.21	29.57	53.90	14.96
δ	± 16.1	± 1.4	± 2.7	± 4.2	± 1.1	± 5.8	± 2.3	± 1.03	± 5.41	± 10.10	± 1.58
Source of information (Literature)	7	13	12	12	14	14	17	11	8	8	9

strated by the Belgian, West German, Polish and Hungarian provenances. Populations from the south of the range (Yugoslavia, Turkey) are much poorer in growth compared to the remainder. One should particularly mention the good growth of seedlings and transplants on all areas from the Ardennes provenance from Belgium, in which country *P. sylvestris* is an introduced species. This is most probably a west German provenance established in the XIX c. from seeds distributed by the Darmstadt seed dealers (Wimmer 1924, from Białobok 1967). Also good results are demonstrated in the IUFRO 1938 trial by another Belgian provenance Herselt (51°03' N, 4°56' E), which regardless of the place of planting was always characterized by good growth (Giertych 1979).

Both provenances from Yugoslavia have shown poor growth, even on an area located near the place of origin. It is difficult to tell now whether this is an effect of elevation of the maternal stands (800—900 m and 1200 m), or whether this is a feature characteristic for the race. The populations from Yugoslavia were so far little employed in provenance experiments of Scots pine (Giertych 1970).

Presently it is of course too early to draw any binding conclusions from the

results obtained concerning height of plants from individual provenances. It appears however that generally the results confirm those of earlier studies made by IUFRO in 1907, 1938 and 1939 (Giertych 1979).

OTHER TRIALS MADE ON THE PLANT MATERIAL
FROM THE SP IUFRO-1982 EXPERIMENT

Besides the experimental areas mentioned earlier, from seeds left at the disposal of the organisers several other experiments were established.

S. Kocięcki (1985) sent more than 5,000 seedlings from 17 origins to the Agricultural Academy in Warsaw to establish a didactic trial. First results from that area localized in the Rogów Experimental Forest have been sent for printing in an internal Agricultural Academy publication (S. Gunia, 1986, personal information).

The Institute of Dendrology of the Polish Academy of Sciences in Kórnik used a part of the seeds on 3 experimental plots located near industrial plants that produce pollution noxious to the environment. A part of the seedlings was exposed also in laboratory conditions to the action of toxic gases. Partial results of these studies have been published (Oleksyn, Białobok 1986; Oleksyn et al. 1988, Karolewski 1989).

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LITERATURE

1. Białobok S., 1967. Zmienność cech morfologicznych i fizjologicznych w zależności od środowiska. In: Zarys fizjologii sosny zwyczajnej. Eds. S. Białobok and W. Żelawski. PWN, Warszawa—Poznań: 9—32.
2. Giertych M., 1970. Zagadnienia genetyczne. In: Sosna zwyczajna *Pinus sylvestris* L. Ed. S. Białobok. PWN, Warszawa—Poznań: 232—261.
3. Giertych M., 1976. Summary results of the IUFRO 1938 Norway spruce (*Picea abies* (L.) Karst.) provenance experiment. Height growth. *Silvae Genetica* 25(5/6): 154—164.
4. Giertych M., 1979. Summary of results on Scots pine (*Pinus sylvestris* L.) height growth in IUFRO provenance experiments. *Silvae Genetica* 28(4): 136—152.
5. Giertych M., 1984. Report on the IUFRO 1938 and 1939 provenance experiments on Norway spruce (*Picea abies* (L.) Karst.). Publ. by Polish Academy of Sciences, Institute of Dendrology, Kórnik, 179 pp.
6. Giertych M., Oleksyn J., 1981. Summary of results on Scots pine (*Pinus sylvestris* L.) volume production in Ogievskij's prerevolutionary Russian provenance experiments. *Silvae Genetica* 30(2—3): 56—74.
7. Giertych M., personal communication.
8. Gračan J., 1987. International provenance test of Scots pine (*Pinus sylvestris* L.). From a paper given at symposium: "Genetic Effects of Air Pollutants in Forest Tree Populations". IUFRO-Joint Meeting 3—7 August, 1987, Grosshansdorf, FRG.
9. Ievin L., Baumanis I., 1984. Personal communication.
10. Karolewski P., 1989. Content of free proline and susceptibility to the action of SO₂, NO₂ and HF of 18 European provenances of Scots pine. *Folia dendrologica* 16: 365—382.

11. Kleinschmit J., 1985. Personal communication.
12. Kocięcki S., 1984. Personal communication.
13. Kocięcki S., 1985. Wyniki siewu sosny pospolitej różnych pochodzeń w doświadczeniu SP IUFRO 1982. Sylwan 129(2): 44—52.
14. Oleksyn J., 1985. Unpublished data.
15. Oleksyn J., Białobok S., 1986. Net photosynthesis, dark respiration and susceptibility to air pollution of 20 European provenances of Scots pine *Pinus sylvestris* L. Environ. Pollut. Ser. A, 40(4): 287—302.
16. Oleksyn J., Karolewski P., Rachwał L., 1988. Susceptibility of European *Pinus sylvestris* L. populations to SO₂, NO₂, SO₂ + NO₂ and HF under laboratory and field conditions. Acta Soc. Bot. Pol. 57(1): 107—115.
17. Stephan B. R., 1986. International provenance trial with Scots pine. Jahresbericht 1985 der BFH, S. N12—N13.
18. Walter H., Leith H., 1958. Klimadiagram Weltatlas, Jena.

Nowe doświadczenie proveniencyjne IUFRO-1982 z sosną zwyczajną (*Pinus sylvestris* L.)

Streszczenie

Przedstawiono założenia, historię powstania, plany poszczególnych powierzchni doświadczalnych oraz pierwsze wyniki pomiaru wysokości siewek w nowym międzynarodowym doświadczeniu proveniencyjnym (SP IUFRO-1982) z sosną zwyczajną. W doświadczeniu reprezentowanych jest 20 populacji *P. sylvestris* z 11 krajów. Stałe powierzchnie badawcze w ramach tego doświadczenia założono w: Polsce (2), NRD, RFN (4), Czechosłowacji, na Węgrzech i Jugosławii. Wyniki pomiarów wysokości wskazują na dobrą dynamikę przyrostów i znaczną plastyczność siewek z Belgii, RFN, NRD i Polski. Populacje z północy zasięgu (Szwecja, ZSRR) oraz południa (Jugosławia, Turcja) znacznie ustępują pod względem wielkości przyrostów pozostałym.

Новые географические культуры ИЮФРО-1982 сосны обыкновенной (*Pinus sylvestris* L.)*

Résumé

Описаны концепция, история заложения, планы отдельных опытных площадей а также первые результаты прироста по высоте нового провененционного опыта (СП ИЮФРО-1982) с сосной обыкновенной. В опыте представлено 20 популяций *P. sylvestris* с 11 стран. Постоянные опытные площади в рамках этого опыта были заложены в Польше (2), ГДР, ФРГ (4), Чехословакии, Венгрии и Югославии. Результаты замеров высоты указывают на хорошую динамику приростов и значительную пластичность семян из Бельгии, ФРГ, ГДР и Польши. Популяции с севера ареала (Швеция, СССР) и юга (Югославия, Турция) значительно уступают по приросту остальным.

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