THE EFFECT OF "ACID RAIN" AND MINERAL FERTILIZERS ON THE BIOMETRICAL FEATURES OF LARIX DECIDUA MILL. SEEDLINGS

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Abstract. The purpose of the present experiment was to describe the influence of various mineral fertilizers on the development of *Larix decidua* Mill. seedlings subject to the influence of simulated acid rain of pH 2.5, 3.0, 3.5, 4.0, 4.5. The seedlings were fertilized every month (from April up to October), in order to counteract acid rain. The composition of the fertilizers was diversified in order to select an optimum variant. Fertilizer with NK applied to the needles (Florovit) and NPK applied to the soil (Fruktus 2) as well as dolomite lime applied to the soil. One row per set was left without fertilization as a control for each pH step of acid rain treatment. The analysis of biometric characteristics showed that a two-year period of investigations was too short to estimate effects on *Larix decidua* Mill. seedlings. It, however, indicated important trends. High correlations were found between particular growth parameters i.e. diameter of root neck, root mass, total mass of: seedlings, needles, main shoots, lateral shoots, ligneous parts, total overground parts. No strong correlations were observed between the above mentioned parameters and the total height of the seedlings. Among the different treatments the best development was achieved at pH 4.0, whereas the weakest development was observed at pH 2.5. The analysis showed a decrease in biometrical features along with an increase in acidity of acid rain solution. The first year of the experiment had the greatest influence upon the growth of *Larix decidua* Mill. seedlings. Significant improvement in growth, in relation to control plots, was achieved by using NK-fertilizers onto needles – the best results, and NPK onto soil. The best increment of the height of seedling was noticed at pH 3.5. In the second year of the experiment the effects of pH of acid rain and fertilization decreased – no significant effect on biometrical features was observed. Applaying NPK fertilizer onto soil showed a positive effect in relation to dolomite treatment. The best increment was noticed at pH 4.0.

1. Introduction

It is claimed that one of the main causes of the new forest dieback is the changes in soil chemistry provoked by acid rain. "Acid rain" causes marked disturbance in the uptake of nutrients by plants and at the same time limits their growth (Altshuller and Linthurst, 1976; Ulrich, 1983; Schütt, 1986; Ulrich, 1986; Abrahamsen *et al.*, 1987; Krause, 1988; Białobok, 1989; Greszta *et al.*, 1990; Huettl, 1990a; Gruszka, 1991). This process occurs expecially intensively on barren grounds e.g. on sands for: *Pinus sylvestris* L., *Pinus strobus* L., *Larix decidua* Mill., *Abies alba* L., and *Fagus sylvatica* L. (Gruszka, 1991). To some extent is counteracted by supplying soil with nutrients and liming (Rugge, 1978; Huettl, 1988, 1989; Zoettl *et al.*, 1989; Huettl *et al.*, 1990; Huettl and Fink, 1991). It is believed that the negative effects of acid rain may be limited by supplying the soil with fertilizers in the form of easily assimilative macroelements i.e. NPK, dolomite (Charitonov, 1970;

Huettl and Wiśniewski, 1987; Huettl, 1988, 1989; Chakravaty and Chatarpaul, 1990; Huettl *et al.*, 1990; Huettl and Fink, 1991).

Mineral fertilization and liming has become one of the main operations to reestabilize the forest ecosystem. In this case fertilization and liming is an important agent of prevention and counteraction negative effects of air pollution and in particular of acid rain on bio-, pedo- and hydrosphere (Huettl, 1986; Zoettl and Huettl, 1986; Huettl, 1987; Brocksen *et al.*, 1988; Huettl and Wiśniwski, 1987).

In my investigation the main aim has been to detect the acid rain effects on the productivity of *Larix decidua* Mill. seedlings treated also with fertilizers and lime.

2. Material and Method

2.1. Field Methods

Artificial acid rain was obtained from a water solution of H_2SO_4 to reach the following pH in KCl values: 2.5, 3.0, 3.5, 4.0, 4.5 under a plastic roof. The average yearly rainfall in nearest area is about 600 mm, but in order to compensate for an increased transpiration under the roof the seedlings were exposed to higher rainfall, 1300 mm per year. Concentrated H_2SO_4 was used in preparing the acid solutions. After mixing the solutions were checked and corrected with H_2SO_4 and NaOH to obtain required pH-values. The water was taken from a deep water well, and the water was filtered to absorb eventual particles. The chemical composition of the water is given in Table I.

The seedlings were prevented from the influence of precipitation by a roof without front and side walls, making other atmospheric factors such as temperature, humidity, fog, dew and others not much different from natural conditions.

One year old seedlings of *Larix decidua* Mill. were used, identical as far as their quality and health were concerned (I class according to estimation used in PGL-Polish State Forest (BN-76/9212–02). *Larix decidua Mill.* seeds were from the Piwniczna Forest Inspectorate (type of forest – Fagetum Carpaticum, 60–80 years, Section 10c). The seeds were germinated in an open greenhouse.

The seedlings were planted in the open greenhouse but under similar conditions on mixed loamy sand (Table II) using separated plots measuring 80 × 80 cm. The plots were separated from one another by a concrete slab 60 cm deep in the ground, in order to avoid the overgrowth of the roots into neighbouring plots and a horizontal dislocation of water solutions of different pH. Each plot contained 6 seedlings. A general plan of the experiment is shown in Figure 1.

The experiment was established in the spring of 1989. The seedlings were planted in March and watered with original ground water for 2 months to facilitate root stabilizing and to eliminate losses caused by the transplantation stress.

TABLE I

Chemical characteristics of water used for preparation of aqueous solution of sulfuric acid

	Unit	pH in H_2O	Na	K	Ca	Mg	Fe	Mn	Zn	Cu	Pb	Cd	Ni	Cr	Cl
Water used	mg/L	7.8	21.48	1.0	31.4	6.2	0.35	6.2	0.175	<0.005	0.03	<0.005	0.07	<0.01	0.97
Added with water	kg/ha/yr	7	279.2	13.0	408.2	80.6	4.55	80.6	1.99	–	0.39	–	0.81	–	4.55

TABLE II

Chemical characteristics of the soil used for experiment

	Unit	pH in H_2O	pH in KCl	N	C	P	Na	K	Ca	Mg	Fe	Mn	Zn	Cu	Pb	Cd	Ni	Cr
Soil	μg/g	7.3	7.1	420	6700	–	130	380	910	410	3270	241	22	14	18.2	1.4	6.3	5.5
Exchangeable elements	μg/g			–	–	27.1	–	18.5	11.5	–	–	–	–	–	–	–	–	–

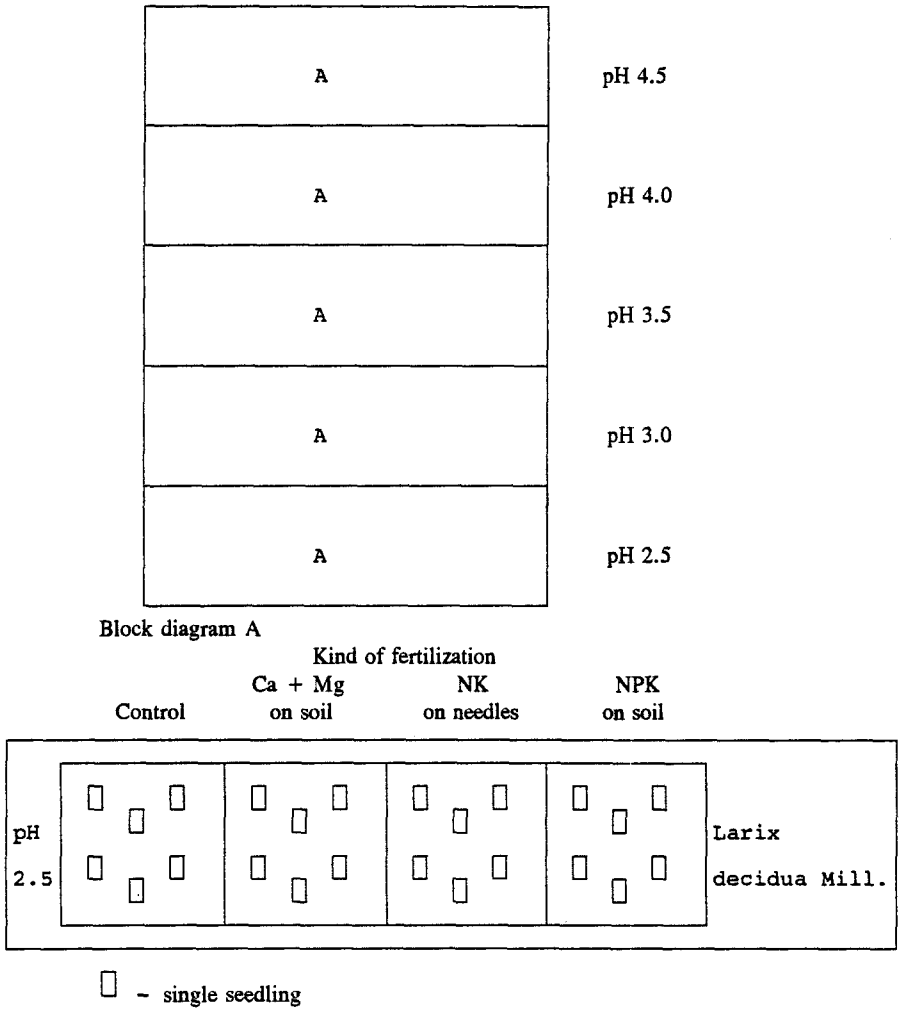

Fig. 1. Diagram of field experiment.

From mid-June on, the seedlings were watered with artificial acid rain each third day. The control plots of the experiment were sprayed only with acid rain of different pH: 2.5, 3.0, 3.5, 4.0, 4.5 each year.

A second serie of plots was sprayed with acid rain like the control plots, and was also fertilized from April to September with dolomite on the soil surface (Ca + Mg on soil): 5% MgO, 70% CaO each year. Eight g was given on each plot and each month, which means: 37.5 kg MgO ha^{-1} yr^{-1} and 525 kg CaO ha^{-1} yr^{-1}.

A third serie of plots was sprayed with acid rain like the control part, and was fertilized from April to September once a month with the mineral fertilizer NK "Florovit" onto the needles (NK onto needles) each year. These plots received fertilizers containing: 3.0% N, 2.4% K_2O, 0.75% Ca, 0.3% S, 0.1% MgO, 400 mg/dm^3

Fe, 150 mg/dm^3 Zn, 150 mg/dm^3 Mn, 70 mg/dm^3 Cu, 30 mg/dm^3 B, 20 mg/dm^3 Mo. Of the fertilizer material was taken 25 mL per 5 L of water from April to September meaning: 12 kg N, 9.6 kg K_2O, 3.0 kg Ca, 1.2 kg S, 0.4 kg MgO, 0.16 kg Fe, 0.06 kg Zn, 0.028 kg Cu, 0.018 kg B, 0.008 kg Mo per ha, per year.

A fourth serie of plots was sprayed with acid rain like the control part, and was fertilized once a month with a solid mineral fertilizer "Fruktus 2" (NPK onto soil) each year. These plots received fertilizers containing: 13.5% N, 5% P_2O_5, 20% K_2O, 5% Mg0, 0.2% Cu, 0.2% Zn, 0.2% Mn, 0.2% Br, 0.01% Mo, in the proportion of 38 g per one plot – which means 175.5 kg N, 65 kg P_2O_5, 260 kg K_2O, 65 kg MgO, 2.6 kg Cu, 2.6 kg Zn, 2.6 kg Mn, 2.6 kg Br, 0.13 kg Mo per ha, per year.

The experiment was carried out in the nursery at Jodłówka for two years, close to Brzesko – 60 km eastwards of Kraków, on the permises of the Brzesko Forest Inspectorate belonging to Kraków District Head Office for State Forests.

2.2. Analytical Studies

After two vegetation seasons, Oct. 1990 seedlings were harwested for analyses. The plant material was separated as follows: main shoots grown in the years 1988, 1989, 1990, lateral shoots from years: 1988, 1989, 1990, needles and roots from the whole seedling; needles in 1990. For determining the mean mass of and length needles were collected from main shoots grown in each year.

The following biometric characteristics were analysed for plants:

1. total heights before start, at the first and second year of the experiment,
2. diameter of the root necks,
3. total mass of: roots, needles, seedling, lateral shoots, main shoots, ligneous and above ground parts of seedling, after the second year of the experiment,
4. a mean mass of 1000 needles and a mean length of 100 needles in the second year of the experiment.

The mass of the analyzed vegetable material was determined by means of the laboratory balance of Medicat Ltd 1600C type with an accurracy up to $\pm$ 0.01 g, and the length and height by the ruler of Skala type with an accurracy of $\pm$ 0.1 cm.

3. Results of Studies

Correlation coefficients for the biometric variables between each characteristic were calculated. The results are given in Table III.

On the basis of analysis of correlation coefficient diameter of the root neck, total dry weight of: needles, lateral shoots, ligneous and above ground parts of seedlings, seedling at the end of the experiment – for these variables the correlation coefficient is higher than 0.850, that is to say, the above mentioned characteristics are highly

TABLE III

Multiple correlation matrix of the analyzed biometric characteristics for *Larix decidua* Mill.

	RND	RM	NM	LSM	MSM	LPM	APM	SM	SH
RND	1.000	0.773	0.905	0.900	0.897	0.926	0.927	0.926	0.780
RM		1.000	0.790	0.753	0.803	0.798	0.801	0.865	0.718
NM			1.000	0.962	0.908	0.967	0.984	0.977	0.749
LSM				1.000	0.882	0.978	0.980	0.967	0.707
MSM					1.000	0.961	0.952	0.953	0.846
LPM						1.000	0.997	0.990	0.794
APM							1.000	0.993	0.786
SM								1.000	0.798
SH									1.000

Names of Variables:

RND – diameter of all roots neck (cm)
RM – mass of a root (g)
NM – total mass of needles (g)
LSM – total mass of lateral shoots (g)
MSM – total mass of main shoots (g)
LPM – total mass of ligneous part (g)
APM – total mass of aboveground part (g)
SM – total mass of seedlings (g)
SH – total height of seedlings (cm)

correlated between each other. For further analysis the total dry weight of seedlings was taken as a representative value for this group. The total height of the seedling, which is not highly correlated with remaining variables (the correlation coefficient is lower than 0.850). This variable should be separately analyzed features. Thus two characteristic features were chosen for further analysis: the total height of a seedling and its total mass (Oktaba, 1971).

When discussing the results of investigations an abbrevations was used, replacing "pH of simulated acid rains" only by pH symbol. The results after two years of the experiment on chosen biometrical features are given in Table IV.

The average of the total mass of seedlings on control plots after two years of the experiment changed from the lowest 38.16 g value at pH 2.5 and increased systematically up to pH 4.0, reaching the largest mass of 92.06 g. After exceeding pH 4.0, the mass decreased and at pH 4.5 it was 78.63 g (Figure 2, Table IV).

The average of the total height of seedlings on the control plots after the 2nd year of the experiment grown from the lowest 63.87 cm value at pH 2.5, to the highest one of 91.28 cm at pH 4.0. Above this value, at pH 4.5 the height decreased to 89.98 cm (Figure 3, Table IV). The same tendency to decreasing the increment of the main shoot has been observed in first year. At pH 2.5 a total height of a seedlings in 1989 was 24.08 cm (the lowest value), while at pH 4.0 it was 38.50 cm

TABLE IV

Average values of chosen biometric characteristics of *Larix decidua* Mill, at the end of the experiment of different pH treatments (± standard deviation)

pH	Total height of seedling in cm on control plots in 1988		in 1989		in 1990		Total mass of seedlings on control plots in g		Total height of seedling in cm on control plots in cm in 1988		in 1989		in 1990		Total mass of seedlings in g on Ca + Mg plots	
	av.	±	av.	±	av.	±	av.	±	av.	±	av.	±	av.	±	av.	±
2.5	14.37	8.14	24.08	11.11	63.87	36.65	38.16	25.05	19.10	6.25	25.07	7.22	75.12	43.23	62.15	48.56
3.0	15.25	5.71	28.12	3.76	70.73	8.92	59.81	23.13	12.50	2.68	41.25	7.51	76.98	20.57	82.13	63.64
3.5	15.75	5.68	35.09	6.86	86.81	14.41	81.29	40.52	17.17	5.25	44.17	12.01	85.48	23.40	96.99	60.99
4.0	17.33	2.25	38.50	12.91	91.28	23.90	92.06	54.02	22.33	5.67	40.25	21.31	102.37	30.38	137.96	99.99
4.5	18.48	3.17	35.95	7.89	89.98	19.58	78.63	20.41	26.33	4.91	40.05	13.06	84.02	26.68	115.51	72.21

pH	Total height of seedling in cm on NK plots in 1988		in 1989		in 1990		Total mass of seedlings on NK plots in g		Total height of seedling in cm on NPK plots in cm in 1988		in 1989		in 1990		Total mass of seedlings in g on Ca + Mg plots	
	av.	±	av.	±	av.	±	av.	±	av.	±	av.	±	av.	±	av.	±
2.5	26.33	8.29	40.05	12.80	86.23	35.34	98.81	86.10	19.50	3.58	32.00	9.37	68.38	35.79	66.41	78.67
3.0	30.08	7.20	44.58	22.78	91.35	43.71	114.84	72.72	19.67	7.49	40.83	11.28	116.93	40.31	135.83	76.82
3.5	12.75	15.08	41.83	6.13	107.23	25.32	148.45	123.15	22.38	4.07	42.71	10.28	120.15	21.90	149.46	87.92
4.0	20.50	8.80	42.78	20.17	114.90	48.62	150.49	154.57	22.75	5.27	56.08	16.32	126.48	39.98	165.46	68.57
4.5	14.33	3.33	55.17	26.82	94.38	53.60	118.43	96.02	20.25	6.31	46.17	21.10	114.80	39.85	134.43	76.15

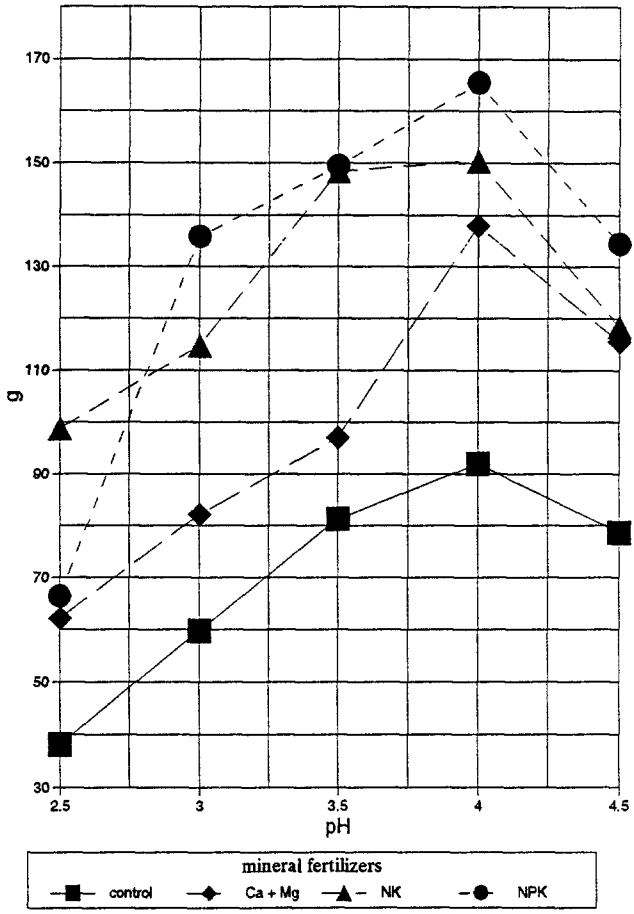

Fig. 2. The effect of different pH of "acid rain" and mineral fertilizers on the total mass of *Larix decidua* Mill. seedlings in 1990.

(the highest value), above this pH the height of a seedling decresed up to 35.95 cm at pH 4.5 (Figure 4, Table IV).

The average of total mass of seedlings, on Ca + Mg plots after the 2nd year of the experiment changed from the lowest 62.15 g value at pH 2.5 and increased systematically up to pH 4.0, reaching the largest mass of 137.96 g. After exceeding pH 4.0 the mass decreased and at pH 4.5 it was 115.51 g (Figure 2, Table IV).

The average of the total height of seedlings on the Ca + Mg plots after the 2nd year of the experiment grown from the lowest 75.12 cm value at pH 2.5, to the greatest one of 102.37 cm at pH 4.0. Above this value, at pH 4.5 the hight decreased to 84.02 cm (Figure 3, Table IV). The other tendency has been observed in first year. At pH 2.5 a total height of a seedlings in 1989 was 25.07 cm (the lowest value), while at pH 3.5 it was 44.17 cm (the highest value), above this pH the height of a seedling decresed up to 40.05 cm at pH 4.5 (Figure 4, Table IV).

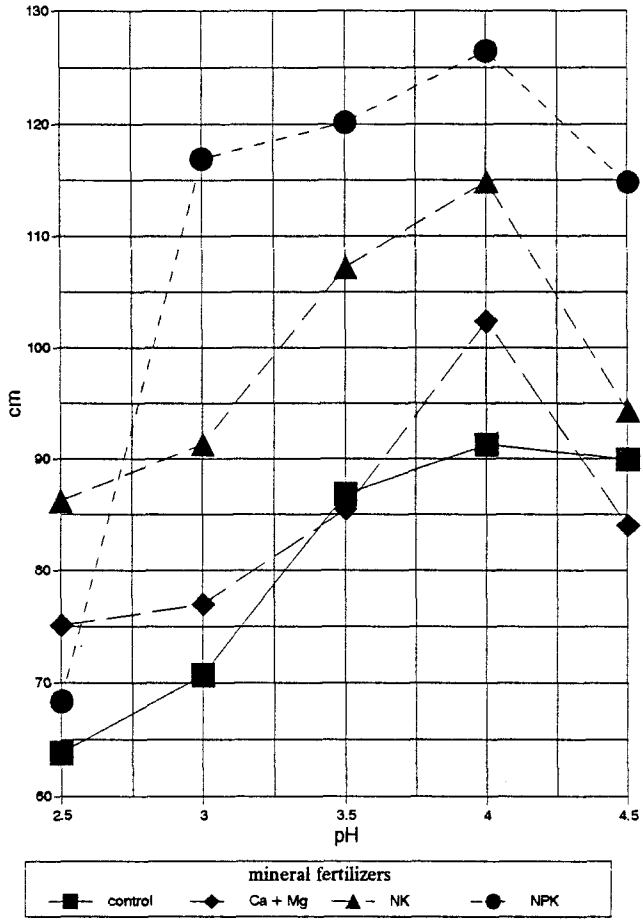

Fig. 3. The effect of different pH of "acid rain" and mineral fertilizers on the total height of *Larix decidua* Mill. seedlings in 1990.

The average of the total mass of seedlings on NK plots after the 2nd year of the experiment varied from the lowest value 98.81 g at pH 2.5 and increased systematically reaching the highest value of 150.49 g at pH 4.0. After exceeding pH 4.0 its value decreased and at pH 4.5 it was 118.43 g (Figure 2, Table IV).

The average of the total height of seedlings on the NK plots after the 2nd year of the experiment grown from the lowest 86.23 cm value at pH 2.5, to the greatest one of 114.90 cm at pH 4.0. Above this value, at pH 4.5 the height decreased to 94.38 cm (Figure 3, Table IV). The other tendency has been observed in first year. At pH 2.5 a total height of a seedlings in 1989 was 40.05 cm (the lowest value), whereas at pH 3.0 it was 44.56 cm, above this pH the seedlings height decreased to 41.83 at pH 3.5, and then it increased achieving 55.17 cm at pH 4.5 (the highest value) (Figure 4, Table IV).

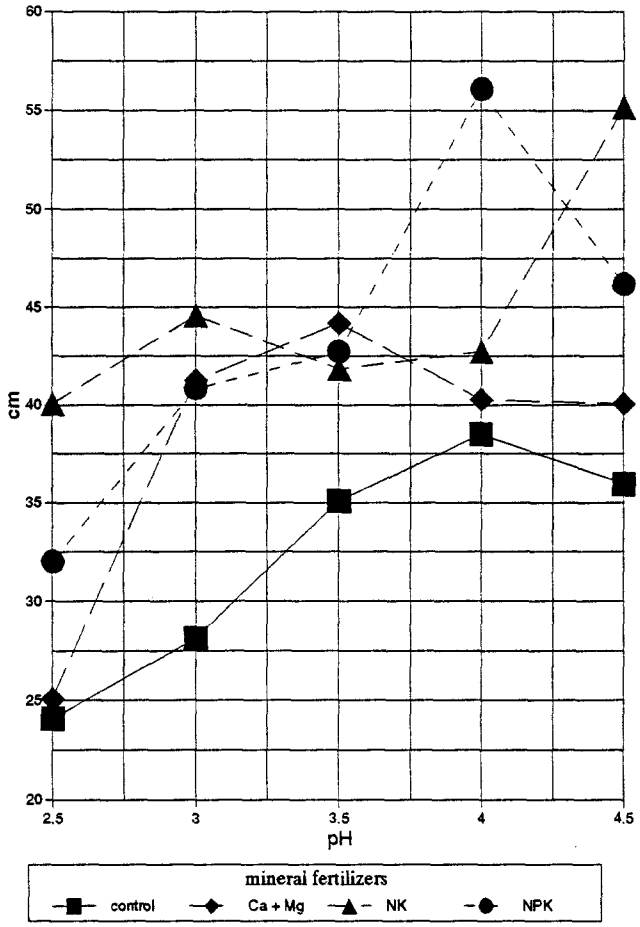

Fig. 4. The effect of different pH of "acid rain" and mineral fertilizers on the total height of *Larix decidua* Mill. seedlings in 1989.

The average of the total mass of seedlings on NPK plots after the 2nd year of the experiment varied from the lowest value 66.41 g at pH 2.5 and increased systematically reaching the highest value of 165.46 g at pH 4.0. After exceeding pH 4.0 its value decreased and at pH 4.5 it was 134.43 g (Figure 2, Table IV).

The average of the total height of seedlings on the NPK plots after the 2nd year of the experiment grown from the lowest 68.38 cm value at pH 2.5, to the highest one of 126.48 cm at pH 4.0. Above this value, at pH 4.5 the height decreased to 114.80 cm (Figure 3, Table IV). The same tendency has been observed in first year. At pH 2.5 a total height of a seedlings in 1989 was 32.00 cm (the lowest value), above this pH the seedlings height increased to 56.08 at pH 4.0 achieving the highest value, above this pH the height of the seedlings decreased to 46.17 cm at pH 4.5 (Figure 4, Table IV).

TABLE V

Two way Analysis of variance indicats significant effects ($P = 0.05$) of: pH of acid rain treatment, kind of fertilization, interaction between pH and fertilization for two biometrical features of *Larix decidua* Mill. seedlings treated with different pH of artificial acid rain and different kind of fertilization for taken homogeneous scheme

Biometrical feature	Total height of seedling after									Total mass of seedling after 1990		
	in 1988			in 1989			in 1990					
Scheme: kind of fertilization/ significant factor	pH	Kind of fertili-zation	Interaction: pH-fertili-zation	pH	Kind of fertili-zation	Interaction: pH-fertili-zation	pH	Kind of fertili-zation	Interaction: pH-fertili-zation	pH	Kind of fertili-zation	Interaction: pH-fertili-zation
Homogenous scheme for pH	2.5, 3.0, 3.5, 4.0, 4.5			2.5, 3.5, 4.5			2.5, 3.0, 3.5, 4.0, 4.5			2.5, 3.0, 3.5, 4.0, 4.5		
Ca + Mg on soil-control				*								
NK on needles-control					*							
NPK on soil-control				*	*							
Homogenous scheme for pH Ca + Mg on soil-NK on needles	2.5, 3.0, 3.5, 4.0, 4.5			2.5, 3.5, 4.0, 4.5			2.5, 3.0, 3.5, 4.0, 4.5			2.5, 3.0, 3.5, 4.0, 4.5		
Ca + Mg on soil-NPK on soil				*				*				
NK on needles-NPK on soil												

3.1. Significant factor effects

The plan of the experiment described in section 2.1 considered two different opposing principles:

1. using of fertilization or not: Ca + Mg on soil-control, NK on needles-control, NPK on soil-control
2. fertilizer application: Ca + Mg on soil-NK on needles, Ca + Mg on soil-NPK on soil, NK on needles-NPK on soil

Inhomogenously of data for a certain treatment indicate that other factors might influence on results. Being a factorial experiment the results were confirmed by analyses of variance (two way Anova factor analysis; Oktaba, 1971). With pH as one factor and fertilizers as the other.

Statistical analyse showed that the total height of seedlings before experiment (1988) was the same and we can draw a conclusion that the experiment was established in a correct way (Table V).

Statistical analyse for total height of seedling after first year indicated differences for fertilization in: "NK on needles-control" and "NPK on soil-control", and pH in: "Ca + Mg on soil-control" and "NPK on soil-control" and "Ca + Mg on soil-NPK on soil" (Table V).

Statistical analyse of average in: "Ca + Mg on soil-control" and "NPK on soil-control" and "Ca + Mg on soil-NPK on soil" showed significant effect of pH on biometrical feature changing the value in first case: from pH 2.5 to 3.5 average increment was 12.06 cm, but from pH 2.5 to 4.5–11.99 cm, in second case from pH 2.5 to 3.5 average increment was 13.02 cm, and in third case changing the value from pH 2.5 to 4.0 an average increment was 20.06 cm. The best increment was noticed for pH 4.0 the worst for pH 2.5.

Statistical analyse of average in: "NK into needles-control" and "NPK onto soil-control" showed that using fertilizers we achived an average increment of biometrical feature in first case 13.98 cm the heighest value, in second case 8.59 cm in relation to control plots for all pH.

The total height of seedling after second year was not significantly affected by fertilizers in Anova tests. Significant effects of fertilization was indicated between: "Ca + Mg on soil-NPK on soil" (Table V).

Statistical analyse of average in: "Ca + Mg on soil-NPK on soil" showed significant effect of NPK on soil fertilization on biometrical feature changing the value in relation to Ca + Mg on soil about 26.63 cm.

The total mass of seedlings was not significantly affected by the pH treatment, as well as by the fertlizers (Table V).

4. Discussion of Results

The obtained results of the analysis of changes of biometric characteristic of *Larix decidua* Mill. seedlings, growing on plots: control, fertilized with: Ca + Mg onto

soil, NK into needles (Florovit), NPK onto soil (Fruktus 2) showed at pH: 2.5, 3.0, 3.5, 4.0, 4.5 of artificial acid rain (a water solution of H_2SO_4) that seedlings generally achieved their best development at pH 4.0, whereas the weakest were found at pH 2.5. This confirms the hypothesis that the low pH reaction is not suitable to larch (Baule and Fricker, 1971; Dahl and Skre, 1971; The Conference of United Nations, 1971; Gruszka, 1991; Małek, 1991, 1993) and that the optimum growth of *Larix decidua* Mill. is at pH of soils within the range of pH in H_2O: 4.7–6.5 (Ivanov, 1970; Fielder *et al.*, 1973, referred to Kowalkowski, 1982). In industrial regions pH of precipitation ranges between 4.0–5.0, in some regions the precipitation may be 3.0 (Evans, 1984; Pantani *et al.*, 1984, 1985) and even less (Likens and Bormann, 1974).

High correlations were found between particular growth parameters i.e. the diameter of root neck, root mass, total mass of: seedlings, needles. main shoots, lateral shoots, ligneous parts, above-ground parts. Whereas no high correlation was observed between the above mentioned parameters and the total seedling height.

The first year of the experiment had a great influence upon the growth of *Larix decidua* Mill. seedlings. Significant improvement of growth in relation to control plots was reached by using NK on needles – the best results, and by NPK on soil. The best increment of the height of seedling was noticed at pH 4.0. In the second year of the experiment the effect of pH and fertilizers decreased – no significant effect on biometrical features, except NPK on soil in relation to Ca + Mg on soil. The best increment was noticed at pH 4.0. The achieved increment on above mentioned plots indicate that complete fertilization can be recommended for nutrient poor soil being under strong pressure of acid rain (Lisenkov and Nipa, 1969; Charitonov, 1970; Baule and Ficker, 1971; Kudasova, 1971; Kowalkowski, 1982; Fober, 1986; Małek, 1991, 1993).

The hypothesis was confirmed (Chakravarty and Chatarpaul, 1990), that supplying a soil with nutrient elements necessary for life, i.e. NPK, in spite of destructively acting acid rain gives a better development of seedlings.

The results of the experiment showed that nitrogen fertilizers influences substantially the increment of seedlings. The maximum increment occurred in the first and second year of the experiment on NK and NPK treated plots where together with other elements N was used in adequate 12.0 kg/ha and 175.5 kg/ha respectively. So the total height development of the *Larix decidua* Mill. seedlings can be increased by applying a small dose of N, on the opposite to Nojd, Malkonen and Kukkola (1987) when applying 150 kg N/ha.

The application of Ca + Mg in the doses: 37.5 kg/ha MgO and 525 kg/ha CaO on poorly nourished soils improved the growth and development of seedlings, but Charitonov (1970) and Thomasius (1970) suggested 2000–3000 kg/ha.

5. Conclusions

1. The analysis of changes of biometric characteristic of *Larix decidua* Mill. showed, that a two year period of study may be too short to estimate correctly influence of various types of fertilization when seedling are affected by simulated acid rains. It, however, permitted to indicate some trends.
2. A substantiale high correlation coefficient was found between different parameters of growth of *Larix decidua* Mill. seedlings, i.e: of the diameter of root nect, root mass, total mass of: seedlings, needles. main shoots, lateral shoots, ligneous parts, overground parts. Lower correlations were observed between the above mentioned parameters and the total height of the seedlings.
3. The results showed, that the best development was achieved by *Larix decidua* Mill. at pH 4.0, and the weakest development at pH 2.5 indicating a decrease in growth with an increase in acidity of aqueous solutions.
4. The first year of the experiment had the greatest influence upon the growth of *Larix decidua* Mill. seedlings. Significant improvement in growth in relation to control plots can be acheived by using fertilizer NK on needles – the best results, and NPK on soil. The best increment of the height of seedlings was noticed for pH 3.5.
5. In the second year of the experiment the effect of pH of acid rain and fertilization decreased – no significant effect on biometrical features due to a higher variation, that might result from density dependant and competition factors on the plots, but applying fertilization NPK on soil in relation to Ca + Mg on soil showed positive effect. The best increment was noticed for pH 4.0.

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