Summary

The growth and nutrient requirements of hybrids between European gray poplar (***Populus canescens*** SM.) and bigtooth aspen (P. *grandidentata* MICHX.) were investigated by comparing the behavior of the two hybrid progeny groups with the performance of seedlings from the "parent species". Interrelated trials were conducted in which the influence of varying N, P, K, a single element at a time, was investigated. Analysis of measurement data revealed there were significant growth differences between the four types of experimental trees. Chemical determinations made on the tops of the trees demonstrated that there were significant between-material differences in the uptake of N, Ca, and Mg. Evidence was also obtained indicating the uptake of certain elements influenced the utilization of other major nutrients. Estimates made of the amounts of nutrients removed from the solutions by the tops revealed total uptake by the European gray poplar seedlings was approximately three times as great as that of the bigtooth aspen seedlings. Nutrient uptake by the hybrids was intermediate between the two parent species.

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Short Note

Systematic Lay-outs for Seed Orchards

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Since 1965 I have discussed the use of systematic lay-outs for seed orchards (GIERTYCH 1965) with several people. The advantages of a systematic lay-out are readily admitted (inbreeding minimized, ease of locating ramets, possibility of extending the lay-out in all directions, and the independence of the lay-out on the size and shape of the orchard) but I have met three criticisms: 1⁰ the system of GIERTYCH (1965) is difficult to use, 2⁰ seed orchards of more than 65 clones are frequently being established and 3⁰ the progeny of such seed orchards will include a large number of full-sibs.

The first criticism has been most frequent but came as a surprise, since I felt that the method was much easier to employ than any other published thus far. The criticism means that in the description of the mathematics used to arrive at the lay-outs the simplicity of their practical usc was lost. This is one point I hope to rectify in this note.

I have also prepared lay-outs for larger numbers of clones (*table* 1) to extend the practical use of the method. I have provided here only information about lay-outs for numbers of clones which give the optimum quadratic scatter of ramets. There is sufficient of these to choose from when planning any seed orchard and I recommend that these be used.

The third argument about the progeny containing too many full-sibs would become serious if we do collect seed from stands established from seed orchard seed. This could lead to inbreeding. However by the time forests established from seed produced in existing seed orchards themselves reach the age of seed production all our seed will be produced in seed orchards. Thus the danger of inbreeding in the second generation should not be exaggerated. Furthermore we can exploit the tendency in a seed orchard for a ramet to be pollinated primarily by its windward neighbour by selecting as neighbours those clones which in combination show specific combining ability. In the systematic lay-out I advocate each ramet of a clone has the same arrangement of neighbours around it and the possibility of using specific combining ability is thereby enhanced.

The computer programs for seed-orchard lay-outs proposed by LA BASTIDE (1967) aim at avoiding repetition of neighbour combinations so as to increase the chances of panmixy. Additive gene effects will influence the progeny of the seed orchard whether there is panmixy or not. Any value or harm we might expect from specific combining ability will average out over the whole seed orchard crop to about the same extent whether we vary the composition of each group of clones or not. Also, as already mentioned above, if anything definite is known about specific combining ability between various clones we can exploit that knowledge by assigning appropriate locations to the clones.

Increasing the chances of panmixy appears to be the only merit of LA BASTIDE'S method over the systematic layout. His method is more cumbersome to use because a new lay-out must be calculated for each number of clones, each number of ramets and each shape of area and the calculations are very expensive of computer time. Moreover the lay-out does not allow for thinning in the seed orchards.

Table 1. — Key to the systematic lay-outs for seed orchards.

No. of clones *n*	Indicator value	Block arrangement	No. of clones *n*	Indicator value	Block arrangement
5	3	1 × 5	149	106	1 × 149
9	7	3 × 3	153	115	3 × 51
13	9	1 × 13	157	29	1 × 157
17	5	1 × 17	169	71	1 × 169
25	19	1 × 25	173	94	1 × 173
29	18	1 × 29	181	163	1 × 181
37	7	1 × 37	185	143	1 × 185
41	10	1 × 41	193	113	1 × 193
45	37	3 × 15	197	15	1 × 197
49	43	7 × 7	205	174	1 × 205
53	31	1 × 53	221	201	1 × 221
61	51	1 × 61	225	205	3 × 75
65	9	1 × 65	229	123	1 × 229
73	28	1 × 73	233	90	1 × 233
81	73	9 × 9	241	178	1 × 241
85	48	1 × 85	245	225	7 × 35
89	56	1 × 89	257	17	1 × 257
97	76	1 × 97	261	226	3 × 87
101	11	1 × 101	265	183	1 × 265
109	77	1 × 109	269	83	1 × 269
113	99	1 × 113	277	218	1 × 277
117	103	3 × 39	281	229	1 × 281
121	111	11 × 11	289	252	1 × 289
125	69	1 × 125	293	156	1 × 293
137	38	1 × 137	305	134	1 × 305
145	13	1 × 145	313	289	1 × 313

Removal of certain clones or regular thinning, either by rows or within rows, will inevitably affect the degree of isolation between ramets of the same clone. In the systematic lay-outs proposed here no such danger exists. If a larger number of clones has to be removed because of their poor combining ability larger gaps may form in the orchard. These will be regularily scattered when the lay-out is systematic and randomly distributed when it is not. In either case they will be a problem. They can be replanted with new clones.

Instructions for Using the Systematic Method

1. Select from *Table 1* any number of clones *(n)* you wish to have in the seed orchard. Note the indicator value and the block arrangement for this number of clones.

2. Prepare a map of the seed orchard in which the positions for the grafts are marked as dots set out in a square spacing.

3. In one corner of the map write in the numbers from 1 to *n* in a block arrangement as indicated. Since for most numbers of clones the block is 1 × *n*, there is only one row of numbers from 1 to *n*. When each block contains more rows (as for example for *n* = 45 where the block is 3 × 15) write in 1 to 15 in the first row, 16—30 in the second and 31—45 in the third row *(fig. 1)*.

4. Write in the second block of *n* numbers in the same fashion starting at 1 under the number corresponding to the indicator value in the first block.

5. Write in other such blocks in a brick-like arrangement, always keeping 1 under the number corresponding to the indicator value of the block above it *(fig. 1)*. In consequence each number will always be positioned below and above

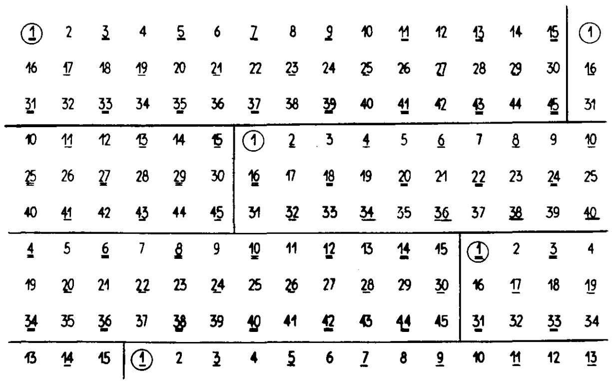

Fig. 1. — Proposed lay-out for 45 clones. (1 st thinnings not underlined, 2 nd thinnings underlined once.)

certain fixed numbers in neighbouring rows. Extend the arrangement to the limits of the map in all directions.

6. Assign the clones to the various numbers as marked on the map. In this assignment make use of any available information about specific combining ability.

The result will be an optimal quadratic scatter of the ramets of each clone. A thinning which removes every second tree can be repeated any number of times. The scatter and proportional representation of each clone will be maintained.

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Buchbesprechungen

Pflanzenphysiologie. Molekulare und biochemisch-physiologische Grundlagen von Stoffwechsel und Entwicklung. Von Dieter Hess. 1970. 367 Seiten mit 248 meist zweifarbigen Abb. Verlag Eugen Ulmer, Stuttgart. DM 19,80.

In der neuen wissenschaftlichen Taschenbuchreihe des Ulmer-Verlages erschien nun von Professor D. Hess, Hohenheim, eine auf molekular-biologischer Grundlage aufbauende, ausgezeichnete Einführung in die Physiologie der höheren Pflanzen. In der Konzeption weicht der Autor von bisher gebräuchlichen Schemen ab und stellt die DNS in den Mittelpunkt der Betrachtungen. „Von der heterokatalytischen Funktion der DNS ausgehend wird in den ersten 10 Kapiteln der Stoffwechsel, von der autokatalytischen Funktion der DNS ausgehend in den folgenden 9 Kapiteln . . . die Entwicklung dargestellt." Breiter Raum wurde den sekundären Pflanzenstoffen gewidmet. Klar und einprägsam geschrieben, bietet das Buch nicht nur dem Anfänger, für den es gedacht ist, einen umfassenden Einblick in die Biochemie der Pflanzenphysiologie. Die zahlreichen, meist zweifarbigen Formelbilder und Zeichnungen sowie die Tatsache, daß auch die neueste Literatur verarbeitet wurde, erhöhen den Wert dieser Einführung. B. R. Stephan

Ecological Studies. Vol. 2: Integrated Experimental Ecology. Edited by Heinz Ellenberg. With 53 figures. XX, 214 pages. 1971. Springer Verlag, Berlin, Heidelberg, New York. DM 58,—.

Im 2. Band der neuen Serie über ökologische Untersuchungen wird das „Solling-Projekt" vorgestellt, das 1966 als deutscher Beitrag zum Internationalen Biologischen Programm begonnen wurde und unter der Leitung von Professor Ellenberg, Göttingen, etwa 50 Wissenschaftler aus den verschiedensten Fachrichtungen zusammenführte. Das Solling-Gebiet, 55 km nordwestlich von Göttingen gelegen, bot die Möglichkeit 4 unterschiedliche Ökosysteme