

Problems of Forest Tree Species Breeding in Russia¹

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It is shown the situation in forest species breeding. It is discussed the further development of breeding researches to according with one of three variants of their financing. It is proposed some measures that could be undertaken on dependent with development of events.

Key words: *genetics and breeding, forest tree species, hybridisation, variety, clones, preservation of genetic fund, development of research.*

The great Russian researcher N. I. Vavilov [2] allocated in breeding of plants seven large sections: 1) doctrine about initial potentials of plants; 2) doctrine about hereditary variability; 3) doctrine about a role of environment in revealing variety attributes and properties; 4) theory of hybridisation both within species and between them; 5) theory of breeding process; 6) doctrine about the basic directions in breeding work - selection on immunity to diseases, on physiology properties (cold - and drought - resistant, photoperiodism a. o.), selection on technical qualities, on chemical structure; 7) particular breeding of separate species. With reference to forestry breeding especial importance have the methods of breeding [3, 12 and other], preservation of genetic fund [9] and some other specific methods.

In study of an initial material for breeding set of the researchers was busy. As result the monographic reports of different breeders [4, 8, 10, 11, 14 and other] are made. However at the moment, probably, are necessary not only data on general laws of variability, but also drawing up a specific data base, which could be used in particular breeding work. It is clear, because of poor financing that new researches are not be carrying out or they are carrying out in very limited scale. And it is lost those results which were created by labour of the predecessors. Collections of the forms, hybrids and varieties left without charges are destroyed. Rate of their updating has sharply decreased. The work on allocation and preservation of genetic fund of forestry species

in natural stands are going slowly; the new programme of these works is stopping.

The doctrine about hereditary variability is, perhaps, obscure section of forest tree breeding. It is caused and clear difficulties, connected to duration of ontogeny of investigated objects, and with lack of planning a general complex of researches, and with false by understood criteria of the practical importance of researches. But without knowledge of the basic laws of important attributes hereditary it is impossible to expect of success of the breeding measures.

Researches on study of a role of environment in revealing of variety attributes and properties, that is testing of variety, creation of geographical, ecological and other test cultures in the last years were carried out extremely a little. So, last variety test culture and only fast growing vegetative reproduction forest species in state scale were created under aegis of a State commission on variety testing of Ministry of agriculture of USSR. The geographical cultures of a state level also were created yet during so-called stagnation period. About creation of ecological cultures discussions are conducted only, attempt of development of the appropriate program is undertaken, however the cultures as such are not almost present. Test cultures, on data of Management of reforestation and forest protection of Federal Forest Service of Russia (FFSR) on 1.04.1996 is incorporated only 547,7 hectares (ha). It provided that in tests require 37 thousand only plus trees, not speaking about trees other breeding categories.

The domestic theory of hybridisation of forestry species is constructed on several postulates, developed yet in the first half of current century (A. V. Albensky, P. L. Bogdanov, A. S. Jablov and other). Basic of them following: before the Mendel representation about a nature of heredity; hybridisation of forestry species should be guided by reception of hybrids of the first generation; the greater effect of heterosis is necessary to expect from remote and incongruent crossings; an opportunity of management hereditary with the help of the factors of external environment and other. Any of these rules can be used and at the moment, other require updating, and some in radical revise. Before study of hereditary laws of this or that attributes some questions cannot be decided essentially. Besides specially by the theory hybridisation in the country it is not enough who is busy. And without the decision of a number of cardinal questions synthetic breeding is doomed on labour consuming,

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long and ineffective way of empiricism, which is slang called "by a method of poke".

If to try to make the list of achieves and made in forest breeding on the sixth and seventh directions the rather impressive document will be received. There will be the place the high productivity pines, oaks, fur-trees and other forest maker species; the fast growing forms, hybrids and cultivars of poplars, and high tannin containing willows; the high resin containing pines and species with figured wood; the winter resistant forms of a walnut and hazel and other high valuable samples of effective researches of forest breeders. Some of these results are reflected in materials of scientific forums of domestic breeders [5, 7, 13 and other]. However recently in view of unclaimed of results by manufacture both sharp of reduction of financing of long-term and labour-consuming researches work in the given direction are in a stage of attenuation. That is, now these works are conducted less intensive, than in A. S. Jablovkov and M. M. Veresin times. At the same time abroad exist and actively work large centres on breeding of separate species, carried out appropriate international congresses, symposiums and other forums.

Thus, even this brief consideration of a situation of businesses shows a rather depressing picture of curtailing of breeding researches in Russia on all directions. And it is not speaking about genetic researches, work on gene engineering, culture in vitro of cells and callus like tissue, genetics of populations and other, connected with the expensive equipment, import chemicals, materials and specially prepared staff. There is the question on what is directed at the moment state support, outgoing from main department and the exclusive owner of woods of the country, FFSR?

As far as it is possible to judge under the last decisions FFSR by a priority direction it is considered a seed - growing. However and here the main share of efforts is getting on creation seed orchards of the first generation. It provided that in the majority of the advanced wood countries already for a long time have passed on creation seed orchards of the second and higher orders [17, 18, 19, 21]. In general it is natural, if work on a genetic estimation of an initial material and on breeding of a new varieties are not conducted, whence can appear and seed orchards of the higher orders?

But even work on creation the constant forest seed base, in necessity of which, seems, already were

penetrated all, as the majority of spent thus work for a long time already have passed a stage of scientific research. Already are developed, and not on one circle, appropriate technical documents, set of the projects is made, and in general these work can be carried out by the prepared industrial engineers, and even these work carried out with enormous tearing off from nearest neighbour countries (Finland, Sweden and other). So, on the last data of Management of reforestation of FFSR and its chief [15], plus trees in Russia is selected 37 thousand. Seed orchards, we shall notice only of the first order, is created on the area 7 534,7 ha. About amount of test cultures was told above. On some data [1], on these 548 ha the offspring of six thousand plus trees are tested. That is 16 percents certificate plus trees, and the posterity of one tree is tested on the area equal 0,09 ha.

The forest covered area in Russia is 655 million ha [6]. Therefore one plus tree is selected on 17 700 ha the forest covered area. In Finland, where forests occupy 20,1 mln ha [20], this figure makes 803 ha, and in Sweden from it 24,4 mln ha of forests and 31 800 plus trees on a scotch pine, fur-tree and lodgepole pine [20, 17, 19, 21]- 767 ha. One hectare of seed orchards in Russia is created on 89 000 ha, certificate one is twice less. The same parameter for Finland, where since 1976 have been created seed orchards of the first order 3300 ha [18], makes 6 083 ha. Thus, and in this priority direction a situation is rather far from the successfulness.

But it is not yet all problems of our breeding, which wait for the prime solution. In all countries, where there are the interested persons and organisations in creation forest stands from improved or variety material, all these work for a long time come true under the certain programs of breeding of this or that forest species. There is the program federal, regional and local, on one species or on which their set, co-ordinated with the program of reforestation as a whole or specific plantations, especially scientific, industrial or complex, short-term, intermediate term or long-term [16, 17, 19, 21]. At us has not yet come in custom to develop such programs everywhere and the more so them to finance. Even those programs, which are developed, and by the order of a FFSR (program of creation of test cultures, introduction, breeding of fast growing species and other) not one years lay dead already.

But well is already the fact, that about it have been started to talk in state bodies of management. So, in the decision of board of FFSR in April 1996 [1] " to

bodies of management it is entrusted to develop the regional programs till 2000, its typical sample as a methodical basis " is given. The truth, to develop it is offered at the expense of own means. It would not be necessary to think poorly about destiny of these programs, but for twenty five years of existence of Institute of forest genetics and breeding the author remembers only one unique case, when the large regional chief of manufacture has addressed to institute with the request to help in questions of forest breeding and has supported this request with the appropriate financing. In all other cases by the initiator of realisation of this or that researches and work institute acted, agreeing to carry out as often as not rather solid amount of works for insignificant compensation of the executors, and frequently and without those.

Estimating a condition of breeding and genetics of forest species in the country, it is possible to see significant backlog in this area of scientific and industrial activity, though some figures of a gain of objects of constant forest seed base, on data FFSR, look and not bad. For example, gain selected plus trees for last five years consist 18%, area of seed orchards 20% and etc. On the other hand the preparation of seed from objects of forest seed base and growing of improved material have remained at a former level or even have decreased. As a whole, to leave on a level of the advanced forest countries large financial assets are necessary, to expect for reception of which at the moment it is impossible. Which variants of further development of events could be assumed?

It is possible to consider three scripts: 1) further degradation and disorder, 2) stagnation and conservatism and 3) optimum and progressive development of scientific researches and their use by manufactures. Which criteria could be put for determination of a kind of the script? The variants can here be different, but presently, by the priority of the so-called market relations, obviously, is impossible to consider forecasts, ignoring this factor. So, as criterion it would be possible to put a ratio of a rate of inflation (on data of independent from ruling groups estimations) and size of a wages (given out particularly on a hands to the scientific personnel, instead of mythical millions common financing, the main share of which leaves on the taxes and overhead charges). So here, in the event that the rate of growth of inflation exceeds rate of growth of the salary (and according to other necessary expenses on scientific researches), it is possible to consider, that the development of forest genetics and breeding

goes on a way of degradation and disorder. If the sizes of these two parameters coincide - there is the process of stagnation and if a gain of means on development of scientific researches on forest genetics and breeding are exceeded by growth of a rate of inflation, it is possible to speak about progressive development of a science and manufacture in the given area.

For the author, it is very heavy to consider the first two scripts, though they and rather are probable. It is clear, that in this case about any progress in forest breeding, in reforestation, in a forest economy as a whole speeches go cannot. But would be naive in view of above-stated to expect optimum development of forest genetics and breeding in the near future. Therefore it be necessary to try to think of those actions, which would be necessary for undertaking, in the event that the events will become to develop under that or other script. Thus expediently to make it at a level of a FFSR, regional bodies of management of a forest economy, research organisations and separate researchers. The author does not incur boldness to develop the program of actions of state bodies and organisations, as well as program of any actions in general. But to state some moment, which seem to him necessary, he will try.

We shall assume, that the further course of events goes as well as went in the last years, that is on a way of degradation and disorder in the field of forest genetics and breeding. What it is possible to undertake in these conditions? It is obvious, that it is necessary to make all, that if and not to rescue all the fact, that already is created, then to take from it a maximum of the information and to keep it up to the best times. Here it is necessary to the researchers to use all accessible them means of archiving and proclaim of received results. It are the publications, deposition, creation a computer personal data base, at last, personal archives, which close confidants of the researchers can subsequently use.

Separate problem can in this case become preservation long-term experienced objects in situ or ex situ created personally or on the initiatives and under the direction of that or other researcher. It would be necessary to keep them from destruction for the subsequent generations of the researchers, with other, right on the intelligent property should here be observed. Already cases are observed, when some, not by available principles of scientific ethic persons, try to appropriate to self authorship or to use such objects in the personal purposes, being not considered with opinion of the people, planning and

creating these objects. Such cases should be condemned scientific community and no doubt to be stopped, for damage from it will incur not only those workers, the interests of which are restrained, but also experimental business as a whole.

There is enough one such case, that began concealment of the design of experience, not informing about found out or brought in the subsequent years changes, enciphering of received data and etc. Common mistrust and reliance that the concept of scientific etiquette exists only in Olympic mountains, instead of on our sinful earth anything, except damage for a science cannot give. Therefore each researcher, author of object, issuing on the passport and deposit it in any organisation, except the general provisions, which should protect his rights, should receive and any document as the receipt from organisation, that it accepts the appropriate documents and objects and they will be not use without the sanction of the author or his scientific successors or without necessary references.

In case the events will become to develop under the second script, that is, curtailing of scientific researches will be stopped. Besides the listed above measures, it would be necessary to use on development not only seed growing, but also on the most perspective directions of breeding researches. To such it is possible to attribute a genetic estimation already allocated improved material of the basic forest species, rise of particular breeding of separate species on varieties level, micropropagation basic forest species, preservation valuable natural and bred genetic fund basic forest species and suitable for creation of especially plantations and some other directions. Without development of which common development of forest breeding will be stopped, and seed growing will catch up a yesterday's day.

It be necessary to pay the special attention to development existing foreign and domestic and development of new methods of researches, and also more complete preparation of the young specialists. It is necessary to let out the new textbooks and methodical manuals on forest genetics and breeding, reflecting a modern level of a world science. Besides it would be necessary to carry out inspection of being available collections, to carry out necessary measurements and supervision, to develop the plans on their restoration, addition and establishing of new. Already under these conditions would have sense to begin development of the real programs of

breeding and plans of introduction them in manufacture.

At development of events under the most favourable third script it would be possible to think about deeper study theoretical and experimental researches, requiring of the expensive equipment, materials, and also creation of large systems of field experience, including the decision of multitarget problems. There will be the need and on attraction of the researches with unique or multiplane preparation. As at the moment this way is represented on period foreseeable future rather utopian, to stop in more detail on problems of this script hardly expediently.

Thus, taking into account all above-stated, it is possible to ascertain following:

- The forest genetics and breeding researches in Russia at last years to a considerable extent stopped and in all directions of breeding it is going the degradation. The forestry economic is unreceptive to assimilation of results of that research, even if they are useful for practice.

- The further development of breeding researches can in the near future go according to one of three variants of their financing: further recourse, stagnation or progress. Taking into account a modern economic situation in the country, first way is the most probable, is less probable second and is the least probable third.

- In a case of development of events on the first variant it would be expedient all efforts to concentrate on archiving of data and preservation of experienced objects. At development on the second variant it would be expedient to reconsider priorities, by concentrating a maximum of efforts just on breeding researches. At realisation of an improbable way of progressive development it would be possible to develop deep theoretical and expensive field experimental research.

The author regrets that his conclusions inspire a little of optimism for development of forest genetics and breeding and would be very glad to be mistaken in the assumptions.

References

1. Борисов О. В трудные времена не забывать про семена // Лесная газета. 1996. 20 апр. №29. С. 1.
2. Вавилов Н. И. Селекция как наука // Вавилов Н. И. Теоретические основы селекции. М.: Наука, 1987. С. 28-29.
3. Вересин М. М., Машкин С. И. Задачи, направления и методы лесной селекции, пути их реализации // Разработка основ систем селекции древесных пород. Рига, 1981. С. 42-46.
4. Полиморфизм популяций кедра сибирского // Изменчивость древесных растений Сибири. Красноярск, 1974. С. 77-103.
5. Лесная генетика, селекция и физиология древесных растений: Материалы международного симпозиума. Воронеж, сентябрь 1989. М., 1989.
6. Лесной фонд России - справочник (по учету на 1 января 1993 г.). М.: ВНИИЦлесресурс, 1995. 280 с.
7. Материалы 1-го съезда Вавиловского общества генетиков и селекционеров (ВОГиС). Саратов, 20-25 декабря 1994 г. // Генетика. 1994. Т. 30. С. 1-190.
8. Махнев А. К. Внутривидовая изменчивость и популяционная структура берез секции *Albae* и *Nanae*. М.: Наука, 1987. 129 с.
9. Положение о выделении и сохранении генетического фонда древесных пород в лесах России / С. А. Мамаев, А. И. Ирошников, А. К. Махнев и др. М.: Федеральная служба лесного хозяйства России. 1994. 21 с. (проект).
10. Правдин Л. Ф. Сосна обыкновенная. М.: Наука, 1969. 189 с.
11. Правдин Л. Ф. Ель европейская и ель сибирская в СССР. М.: Наука, 1975. 178 с.
12. Пятницкий С. С. Практикум по лесной селекции. М.: Сельхозиздат, 1961.
13. Развитие генетики и селекции в лесохозяйственном производстве: Тезисы докладов Всесоюзного научно-технического совещания. Воронеж, 22-23 сентября 1988. М., 1988.
14. Семериков Л. Ф. Популяционная структура древесных растений. М.: Наука, 1986. 141 с.
15. Шубин В. А. Воспроизводство лесов - одна из важнейших задач отрасли. // Лесное хозяйство. 1995. № 3. С. 2-4.
16. Danell O. Breeding programs in Sweden. 1. General approach // Breeding programs in Sweden. Arbetsrapport №302, Skog Forsk. Uppsala, 1995. P. 1-4.
17. Ericsson Tore. Lodgepole pine (*Pinus contorta* var. *latifolia*) breeding in Sweden – results and prospects based on early evaluations: Dissertation Swedish University of Agricultural Sciences. Umea, 1994. 64 p.
18. Jouni Mikola. Forest tree breeding in Finland // Paperi ja puu – Paper and Timber. 1992. Vol. 74. No 2. P. 83-88.
19. Karlsson B., Rosvall O. Norway spruce// Breeding Programmes in Sweden. Arbetsrapport No 203, Skog Forsk, Uppsala, 1995. P. 16-21.
20. Metsatilastollinen vuosikirja 1993-1994 (Yearbook of Forest Statistics). The Finnish Forest Research Institute. 1994. Agriculture and Forestry. 1994:7. 348 p.
21. Wilhelmsson L., Andersson B. Breeding of Scots pine (*Pinus sylvestris*) and Lodgepole pine (*Pinus contorta* ssp. *latifolia*)// Breeding Programmes in Sweden. Arbetsrapport No 203, Skog Forsk, Uppsala, 1995. P. 5-15.