

УДК: 630\*231

## SUCCESS OF NATURAL SEED REGENERATION OF SCOTCH PINE AT THE COMMON TYPES OF FOREST SITES

*S. Sendonin, M. Bilous*

In this article the results survey of successful of natural seed regeneration of Scots pine in common types of site conditions are presented. It is also found out that fresh pine woods are the most favourable for restoring pine forest types both under their canopy and in clearcuts

**Key words:** *natural regeneration, forest site type, foust stand, canopy, clearcut*

In most of developed countries foresters try to use different measures for conservation and development of natural regeneration as far as naturally formed plantations are firmer and more productive on the one hand, and on the other hand, the costs for afforestation of areas and cutting speeds are dramatically reduced while using previous natural regeneration.

Forestry in our country is also gradually trying to turn to this type of management. That's why it is important to research the possibilities of using the existing natural regeneration regardless of forest growing conditions and ways of their improvement as well as growth and development stimulation, which will guarantee its future use in reforestation.

Unlike coal, oil, gas and other mineral resources, wood is recoverable natural resource. However, its recover ability varies in different environmental conditions. Forest restoring is not only biological phenomenon, but also geographical, so its implementation and acceleration in different vegetation and industrial-economic conditions require differentiated measures. The more deeply the natural patterns of forest regeneration and its regional characteristics are explored, and the more they rely on the latest scientific achievements and up-to-date economy experience, the more they will be successful.

Forestry faces the necessity to increase productivity and to improve forest quality. This important national economic problem depends on solving theoretical and practical problems of reforestation [6].

Therefore, an important condition for using natural regeneration of Scots pine is to clear up its recovery and success factors that affect it in the most common forest growing conditions.

When the main species is pine, it is necessary to allocate forest growing conditions with stable and unstable natural regeneration.

While stable natural regeneration forest growing conditions are characterized by direct correlation between seed years and the number of undergrowth. In Polissya and Forest-Steppe these include wet, damp and wet forests, as well as pine forests.

Forest growing conditions with fragile natural regeneration are characterized by lack of correlation between the number of renewals and seed years. Here it is observed the emergence of undergrowth during wet growing seasons for 2-3 years. These types include fresh forests, pine forests and complex pine forests.

At the same time, dry forests, pine forests and complex pine forests are types with single natural regeneration [4].

Though in all types of forest growing conditions in a particular region, natural regeneration should be divided into recovering under the forestry canopy and in open areas, because they are opposite, sharply divided and at the same time often inherently linked.

Likewise, while determining the success of Scots pine natural regeneration we should not neglected both climatic (warmth, moisture, air) and geographical (macro-/micro-climate, macro-/micro-topography, zone vegetation types, live over-ground cover, litter, upper soil horizons etc.) factors that determine favourable or unfavourable conditions for restoring environment [2, 3].

**The aim of research** was to assess the progress of success of natural seed renovation of pine in the most common types of growing conditions in Ukrainian Polissya.

**Materials and methods of research.** Studying of forest renovation processes was conducted with the help of route-key method using stationary and semi-stationary investigations. Route researches were presided by detailed studying of materials characterizing forests and natural areal features, which have been studied, and conducting reconnaissance surveys for developing a preliminary research scheme.

Route researches make it possible to gather materials necessary for general characteristics of forest renovation processes in cuttings and burnings, to examine the dynamics of live over-ground cover and undergrowth on experimental plots.

While studying forest renovation processes, first of all it is necessary to establish undergrowth number, the degree of its viability under the stand canopy of different thickness in the most common forest types. This can be achieved by renovation accounting on both research areas and plots specifically delineated for this purpose.

For this it was applied A.V. Pobedinskyi's technique [5], when for obtaining reliable data, they are laid accounting areas on three equally distant parallel lines of research plots. In this case, through the middle of the research plot in parallel with its two sides is made cutting. On this line and on two parallel sides of an experimental plot in 5-10 m they mark centres of accounting areas on the assumption that on each line it must be the same number (usually no more than 10). The area of these plots is 4 m<sup>2</sup>. In some cases (much undergrowth with equal distribution on the area) the accounting plot area can be reduced to 1 m<sup>2</sup>, and their number – to five or seven on each line.

At each plot they calculate undergrowth with transferring its quantity on 1 ha, measure its height and determine its age (according to whorls or annual rings near the root collar).

**Research results.** To preserve the experiment purity, all experimental plots were selected in pure average-thick mature pine forest stands with relevant valuation characteristics both before and after cutting.

As it is known, one of requirements for successful natural seed restoration in cuttings is the amount of sowing seeds before cutting and after it. Under the terms of long-term observations in fresh and wet pine forests, as well as in complex pine forests, seed periods happen again almost annually with greater or lesser intensity which provides satisfactory sowing of cutting area even in non-productive years. At the same time in maturing and mature pine forestry there fall about 200-500 thousand units of valuable seeds per ha<sup>-1</sup> in average, which can give stairs.

But the presence of this condition does not allow successful seed renovation in particular forest growing conditions. It is important in this process to provide germination and further undergrowth preserving.

Taking into account that while the natural pine seed renovation studying the plots were similar in their forest valuation indicators, attention should be paid to the impact of living over-ground cover and undergrowth in corresponding forest growing conditions.

Most successful pine renovation on fresh cuttings is held in fresh pine woods where there are stairs under 1 year and 1-4-year-old undergrowth (Fig. 1). This is provided by good seed spreading while cutting and destruction of mineral part of soil while hauling, as well as by disproportionate disposal of live over-ground cover of breckland thyme (*Thymus serpyllum* L.), dwarf everlast (*Helichrysum arenarium* (L.) Moench), cranberries (*Vaccinium vitis-idaea* L.), pleurozium schreberi (*Pleurozium schreberi* (Willd. ex Brid.) Mitt.), common heather (*Calluna vulgaris* (L.) Hull), and by absence of undergrowth. These species do not form a dense grassing which makes it possible to provide not only preliminary and accompanying natural renovation, but further one from ripe forest as well.

Quite different situation is with wet forests and pine forests where the main competitors for pine seedlings are moor matgrass (*Nardus stricta* L.), which forms dense sods, hairy wood-rush (*Luzula pilosa* (L.) Willd.), and bilberry (*Vaccinium myrtillus* L.), that's why only preliminary and accompanying insignificant update – up to 1.0 thousand units per ha<sup>-1</sup> – are observed here.

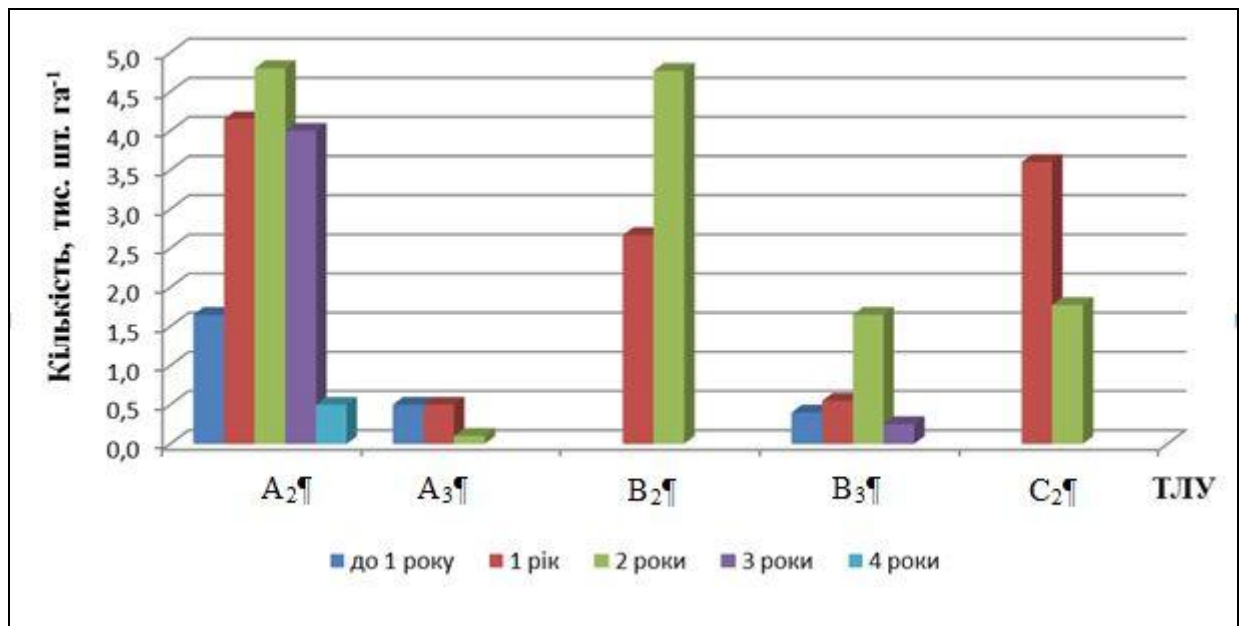


Figure 1. Distribution of pine seedlings according to the forest growing conditions on cuttings

In fresh pine forests it is observed 1-2-year old undergrowth, which was formed during stand cutting. But later it will suffer from harsh competition with live over-ground cover formed by bushgrass (*Calamagrostis epigeios* (L.) Roth).

The similar process occurs in fresh complex pine forests, where along with the competition with live over-ground cover, undergrowth suffers from lack of light caused by overgrowth of underbrush species such as common hazel (*Corylus avellana* L.), black elder (*Sambucus nigra* L.), alder buckthorn (*Frangula alnus* Mill.) and blackthorn (*Prunus spinosa* L.).

Under the forest stand canopy, where the forest environment is fully preserved, in contrast to cuttings, where its abrupt change takes place, which together with abovementioned factors influences the undergrowth adaptation and its further surviving, the seed renovation process is somewhat different (Fig. 2). For example, in dry forests small renovation is observed in the shade of trees where the soil keeps more moisture, that's why the undergrowth is thin here and is distributed disproportionally throughout the area (like clumps).

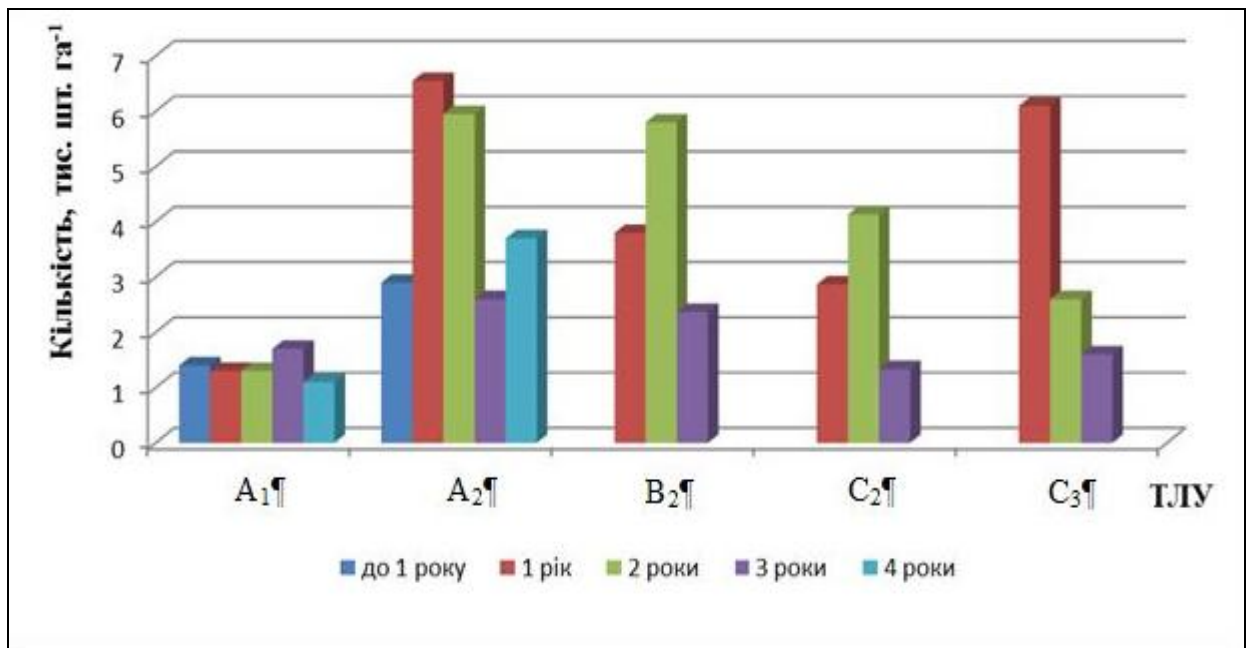


Figure 2. Distribution of pine undergrowth according to forest growing conditions under the stand canopy

In fresh woods and pine forests under the stand canopy it is observed numerous undergrowth of pine in good condition, which is caused by minimal competition with live over-ground cover and underbrush absence. Unlike fresh and wet complex pine forests where soil fertility improving causes the growth of species variety of live over-ground cover and undergrowth, the dense over-ground cover prevents seed germination, while undergrowth together with parent canopy creates undergrowth shading, which in the case of lack of light has dry post, its quality decreases, and, in the case of absence of care, it completely dies at the age of 3-4 years.

### Conclusions

The quantity and quality of natural pine seed renovation has some connection to forest growing conditions with obvious influence on its course of live over-ground cover and undergrowth. Most favourable for renovation of pine stands are fresh forests both under the stand canopy and on the cuttings. To achieve its greater number in these conditions we should promote natural regeneration, and for preservation and development, we should use appropriate technologies while logging and carry out further care of undergrowth.

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# УСПЕШНОСТЬ ЕСТЕСТВЕННОГО СЕМЕННОГО ВОЗОБНОВЛЕНИЯ СОСНЫ ОБЫКНОВЕННОЙ У РАСПРОСТРАНЕННЫХ ТИПАХ ЛЕСОРАСТИТЕЛЬНЫХ УСЛОВИЙ

*С.Е. Сендонин, М.М. Белоус*

Приведены результаты обследования успешности естественного семенного возобновления сосны обыкновенной в распространенных типах лесорастительных условий. Выяснено, что благоприятными для восстановления сосновых древостоев являются свежие боры как под их пологом так и на вырубках

*Ключевые слова:* подрост, тип лесорастительных условий, лесное насаждение, полог, вырубка

# УСПІШНІСТЬ ПРИРОДНОГО НАСІННЕВОГО ПОНОВЛЕННЯ СОСНИ ЗВИЧАЙНОЇ У НАЙПОШИРЕНІШИХ ТИПАХ ЛІСОРОСЛИННИХ УМОВ

*С.Є. Сендонін, М.М. Білоус*

Наведено результати досліджень успішності природного насінневого поновлення сосни звичайної у найпоширеніших типах лісорослинних умов. З'ясовано, що найсприятливішими для поновлення соснових деревостанів є свіжі боры як під їх наметом так і на зрубках

*Ключові слова:* підріст, тип лісорослинних умов, лісове насадження, намет, зруб