FOREST CROP PLANTING HERITAGE OF PRODUCTION UNIT OF NATIONAL UNIVERSITY OF LIFE AND ENVIROMENT SCIENCES OF UKRAINE "BOYARKA FOREST RESEARCH CENTER" AND ITS PRESENT VALUE.

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Forest crops, forest crops case, forest crop heritage, restoration of forests, reforestation, and afforestation special value.

An important basic for scientific explanation and effective implementation of new approaches and progressive technologies to the practice of local forestry considered to be research facilities that once has been done and still using in the forest sector lands of Ukraine by scientists, researches, teaching staff and manufacturing workers. Based on the duration of forest growing in Ukraine – forest planting heritage became a special value of past and present generation of foresters that includes not only historical aspects but already approved algorithms of solving problems connected to the forest regeneration. In this case the most valuable considered to be the heritage of growing forest crops of foresters and scientists of Production Unit of National University of Life and Environmental Sciences of Ukraine "Boyarka Forest Research Center" that 120 years of experience. The importance of this acquisition enhances with geographical location of the forest station which places in the southern part of Kyiv Polesse zone and northern Right-Bank Forest Steppe zone and it's educational and research institutions direction. In the forest fond of the enterprise mainly grow high productive natural forest and artificial plantations where dominant is pine, that characterized here with the highest production index (bonitet) in the region in the borders of its growing areas. That is why it presents high interest and determines the feasibility for comprehensive research.

The production Unit of National University of Life and Environmental Sciences of Ukraine "Boyarka Forets Research Center" (on the moment of organization – Boyarka forest enterprise) got the status of teaching and research

center in 1925 in the same time with the opening of Forest engineering department of Kyiv Agricultural Institute. After the 80 years of forest management of the Forest Research center it has its specificity. Herewith the forest planting activities of the center mainly oriented on educational goals and have its research nature. During this time on its base has been done about two thousand educational and research objects. A lot of experimental forest crops were established in postwar times. The most attention of the scientists of the center were oriented on: studying agricultural technologies of growing forest crops of pine – the main forest forming specie of Polesse and northern regions of Steppe, research of the ways for increasing the productivity of mixed stands of the region, analyses of methods of forest reclamation of heaps, processing features of forest plantation growing and introduction of tree species. Scientific work of the forest research center is closely connected with names of such famous forester as: E.V. Alekseev, E. V. Votchal, P.S. Pogrebnyak, D. I. Tovstolis, and Z.S. Golovyanko, A.P. Tolskiy, I.O.Yahonto, R.T. Kravchenko, V.E. Shmidt, M.M. Yagnychenko, P.G.Kalnoi, B.I. Logginov, K.E. Nikitin, D.D. Lavrynenko, M.I. Gordienko, M.I. Onyskiv, M.V. Ur, V.E. Svyrydenko and many others. Positive affect had involvement of main specialists of enterprise and experienced foresters to establishing experimental scientific objects and realization researches. Nowadays important value has complex researches on educational objects of forest crops growing heritage by scientist, post - graduated students, Master students and its effective use in educational – practice activity while preparing specialist for the work in forest sector.

The purpose of the researches that has been done was actualization the importance of forest crop growing heritage of National University of Life and Environmental Sciences of Ukraine “Boyarka Forest Research Center” for industrial, scientific and social activities and looking forward to increase effectiveness of using achievements of scientists and foresters of the enterprise for intensification and ecologization forest management in the region.

Objects and research technics. The objects of the research were forest stands, which were generated while establishing different researches, their

conditions and scientific value. While conducting the research general scientific methods of getting knowledge were used: analyses, synthesis, generalization and many others. Silviculture and forest inventory characteristics of the stands were using traditional methodic [2]. In the base of the held generalization were publications of past years [6] and the results of own works, supervisions and printed scientific works [10, 21, 22].

Results of the research. A great number of forest crops that are scientific objects, in the forest of research station caused by the predominance of artificial forest regeneration in this place since the late nineteenth century. Transition from natural regeneration to artificial forest regeneration caused by number of reasons, in particular : implementing forest clear-cuts, low effectiveness of seed trees, that were left felling (40-60 trees per ha.) , using forest felling areas 50 m. wide and more, long period (7-15 years) of forest natural regeneration.

First successful forest plantings on the clear felled areas were held in 1883. [6]. Until 1917 while creating forest crops it was common to plant 1-2 years old seedling on uprooted forest cutting areas after 2-3 year period of agricultural use . Planting forest crops initially was performed by planting pin and later by drill of Rosanov and Kolesov “sword” . The initial density verified from7, 2 up to 9, 9 thousand seedlings per ha, in other cases – 14, 4 thousand seedling per ha.

Until nowadays the results of P.G. Kolnogo [8] researches saved practical value for sowing department of Plesetske forestry and effectiveness of cultivation in the fields of crop rotation nurseries of Polesse and northern regions of Steppe cultures of one year and perennial Lupinus. .Not less interest present materials of B.I. Logginov and G.S. Koretskogo [7] about effectiveness of agricultural techniques in growing seedlings of birch using regulation and optimization of the nutrients level and researches of M.I. Onyskiva [14] about influence of different types of pre – cultivation of spruce seeds on growing energy and germination. Most part of educational and scientific objects established in the Production Unit of National University of Life and Environmental Sciences of Ukraine “Boyarka Forest Research Center” concerned forest crop production. . The most valuable,

that did not lose its value till now considered to be postwar (1937–1940.) forest crops of summer planted pine of V.E.Shmidt [24] and post was artificial forest stands of M.V. Ura [25] with different depth of soil scarification, and planting seedlings and their impact on the quality on growth, as well as classical forest crops of pine of P.G. Krotkevycha and M.M. Yahnychenka with different initial density that were carefully researched by Y.M Savich [17, 18] during long period of time.

Long history in the forests of the center have researches about establishing forests and features of planting agrotechnics of fast growing (prototype of plantation forest growing), in particular poplar, that started I.A. Nikitin [12] in 1962 on the Yasnogorodska cottage lands of Zhornivka foretry. Some interest from the standpoint of increasing the value of marketable timber represent researches P.G.Korotkevych [5], that cause technology of growing unbought pine timber, whose results are still using in Sweden, Germany and other European countries while caring about quality of " trees of the future"

Particularly noteworthy research facilities dedicated to the introduction of tree species and their exploitation [4], use of growth substances [1], corrected pine plantations in poor condition and create understory [15], mechanization of forest crop planting [9] and other.

Given the current needs and today global and regional challenges its equally important to continue the glorious traditions, update and laying of new research and educational facilities in the forests of the research center in order to enrich its silvicultural heritage. These sites primarily created with the initiative of the head of the department of forest crops of UAA - professor P.G. Kalnogo by co-workers (T.T. Maluhin, V.M. Beheboyu, V. M.Maurer and F.M. Brovko) and students of forest faculty and "Boyarka Forest Research Center (V.S. Kurylo, V.I. Maslai, M.I Onyskiv, O.G. Zhuk and others) research artificial plantings to study silvicultural characteristics of different ways of preparation for planting forest areas after clear cuttings in B2 condition (1978) , growth and ecological - geographic condition of Scots pine (1981).

Forest stand on which place of growing were established research forest crops with different preparation of clear cut areas, was growing in B2 conditions and till the time of final felling had in its composition 10Pine+oak, age 120 -140 years and 304 stems per ha. Experimental plot was separated on 4 parts - 1, 5 ha each, and characterized with different type of preparation the forest clear cut area to afforestation. First plot – control, presented forest clear cut area using traditional technology: where trees were cut with chainsaw and the height of the stump was not more than 1/3 of the tree diameter. On the second plot stumps height was reduced to the level the ground using stump cutting machine MPC-1,5 (constructor V. I. Maslai) for the purpose of improvement conditions for mechanization of works connected with establishing forest crop areas. Third and fourth areas of after clear cutting preparation presented methods where all stumps were removed: uprooting stumps with the puller D – 496 (third area) and felling trees with the roots by tree fuller DK-1 (constructor V.S.Kurylo, the fourth area). In this case all stumps were removed outside the research area and stacked in piles along the plot in two meter high rows and general area consisted 0,4 ha and on the experimental plot roots were combed out.

Tillage – overall: on uprooted areas – used plow PLN 4-35 and on the not uprooted areas – plow PLD – 1, 2.

One year old seedlings were planted with forest planting machine SBN - 1A. Planting scheme – 3,0m. x 0,7m.Tree species mixing scheme – 4 rows of Pine and 1 rows of oak. Care in crops spacing held during 4 years by cultivator KLB – 1,7, and care in rows manually using next scheme: 5(4)-4(3)-3(2)-2(1)-1 [3].

Conducted studies found that until linking up crowns grow better, by better quality work on the cultivation of the soil, planting seedlings and farming, seedling of pine were different on the areas where roots were removed (3 and 4 areas) and starting from 20 up to 30 years – forest crops on the not ratified areas (control 1 plot). For identical completeness forest crops characterized by the largest margin in the control (Table .1). The authors of the work explain this from the position that while removing roots from the area the soil becomes poorer on nutrients.

Table 1 – Impact of the soil cultivation type on growth and productivity of 24 years old pine, B2

Type of preparation forest clear cut area(removing or not removing roots from the area)	*Number of trees per ha*	*D, cm*	*H, m*	*Production index*	*G, $m^2 \cdot ha^{-1}$*	*Competitiveness*	*Volume $m^3 \cdot ha^{-1}$, P=0,8*
1. Stumps uprooting with up rooter machine D-496	1840	13,4	12,5	I^a	25,8	0,72	180
2. Felling trees with tree feller DK-1.	2080	13,0	12,7	I^a	27,4	0,77	185
3. Height stumps reduction with MPC – 1, 5.	1360	14,4	12,6	I^a	22,0	0,62	185
4. Control (without uprooting and height stump reduction)	1360	14,3	13,2	I^b	21,8	0,61	195

From these two types of uprooting stumps on forest clear cut areas the most economically and ecologically improved considered to be tree fuller uprooting. According to V.M. Portnoi [16] while cleaning the area with tree fuller DK – 1 compare to uprooting stumps, the size of under root space is smaller, roots come out from the soil better and root system cleaning from the soil.

In general, both these ways of preparing future forest crop area, that include removing area from the stumps did not find wide popularity in forestry, nevertheless they have few positive aspects.

Next object, ecological- geographical forest crops of pine, was established in 1981 by teachers (V.M.Maurer, F.M.Brovko), students of forest faculty and scientists of research center (M.I.Onyskiv, O.G.Zhuk) from the initiative of the head of the department of forest crops, professor – P.G.Kalnogo.

To create ecological – geographical forest cops during 1979-1980 were collected seeds from pure pine stands that 70-90 years old with production index I that grew in the same site conditions B2 but different climatic conditions: Polesse

Поліссі (№ 1. West Polesse, Volyn region. 2 - Central Polessye, Zhytomyr region. 3 - Eastern Polesse, Chernihiv region. 6 - Polessye Kiev, Kiev region) Steppe (4 - West Steppe, Lviv region. 5 - The right-bank forest-Steppe, Cherkasy region.; Var.7 - Left Bank Steppe, Sumy region.) Step (8 - Luhansk region of Ukraine and Belarus Gomel (var.9) and Voronezh oblast, Russia (var. 10).

Forest crops were established in B2 conditions on the overall cultivated clear cut forest areas where trees were felled with roots using tree felling machine DK -1with placement of rows from north to south with scheme of planting seedling 2,0 x1, 0 m in two repetitions [10]. The last inventory in the ecological - geographical forest crops was in 2011 (Table 2).

Research of this object in general prove conclusion that pine forest crops where seeds from Polesse lowland and Baltic region were used has advantage on all other seed souses from all Europe. [22].I can be easily explained by significant heterozygosis of pine in Polessye since it was formed after the retreat of the glacier by the merger of isolated parts of this area.

Results of this research were used while writing PhD theses by M.V.Sbytnou [20] and S.I. Sagaidak [19**Ошибка! Источник ссылки не найден.**].

Table 2 – Taxation characteristics of 32 years old ecological – geographical forest crops of pine

№ of variant	*Number of trees per ha* $^{-1}$	*D, cm*	*H, m*	*G* $m^2 \cdot га^{-1}$	*Competitiveness*	*Volume m3/ha*	*Production index (bonitet)*
1.	2481	13,6	16,0	36,07	0,80	291	I^b
2.	2519	14,3	15,4	40,47	1,00	316	I^a
3.	2652	14,9	17,0	46,18	1,03	392	I^b
4.	2348	14,8	16,6	40,39	0,90	336	I^b
5.	2386	14,3	16,5	38,29	0,85	317	I^b
6.	2689	15,1	17,0	48,16	1,07	409	I^b
7.	2481	14,6	15,7	41,27	1,02	323	I^a
8.	2197	14,3	15,0	35,47	0,88	270	I^a
9.	3390	12,7	14,7	43,10	1,19	326	I
10.	2633	13,4	15,0	37,19	0,92	285	I^a

The object of PhD theses often were forest crops of pine with different initial density that were established in spring 1949 in of block # 80 of Boyarka forestry. According to literature review [6] - the history of their establishment connected with the docent's names of the forest crops department of Kyiv forestry institute P.G.Krotkevych and M.M. Yagnychenka. Researched forest crops were planted with one year old seedlings using "sword" of Kolesov where arrangement of planting beds scheme with initial density was: 2.5, 5.0, 7.5, 11.5, 17.5, 24.5, and 30.0 ths. • ha-1.

In 1951 V.M. Ovsankin and Y.M. Savych established 7 permanent experimental plots on which systematic studies take pace since that time [17, 18]. Present characteristic of forest crops presented in the Table 3.

Table 3 – Taxation characteristic of 71 years old pine crops with different initial density (block # 80 of Boyarka forest unit)

№ Of exper.plot. пр. пл.	*Initial density thous. / ha*	*Number of tress thous. /ha* ^{1}	*D, cm*	*H, m*	*G,* $m^2 \cdot ha^{-1}$	*Prod. Index*	*Competitiveness*	*Volume Запас,* $м^3 \cdot ha^{-1}$
1	25,0	0,81	27,7	27,3	48,7	I^a	0,97	629
2	11,5	0,68	28,0	28,1	42,0	I^a	0,83	559
3	7,5	0,79	27,6	27,2	47,7	I^a	0,95	613
4	5,0	0,72	28,7	27,8	46,4	I^a	0,92	611
5	2,5	0,66	31,2	29,0	50,2	I^b	0,92	688

While researching forest crops it is important to consider intensive apostasy of trees in the age of 13 -20 years as a result of snow damage that significantly influenced their initial density. Stronger were influenced high density stands. In high density forest crops (17, 5–25, 0 thousand per ha) left only 43-58 % of initial number of trees and in low density stands (2, 5–7, 5 thousand per ha) – their safety was 64 -82 %

These data indicate the feasibility in determining the initial density of Scots pine, consider not only the type of site conditions, but also the purpose of created plantations and silvicultural potential of planted area.

In the context of actualization of implementing adaptation approaches to forest regeneration, particularly important objects that characterize successful natural regeneration and the possibility of using it for reforestation. This facility is at the initiative of the leading scientist the Department of reforestation and afforestation was founded in 2010 in C2 condition on the 2, 2 ha area after fresh clear cut in Plesetske forestry (block 275, section 26.)On the research plot in February – May 2010 has been done narrow regenerative clear cutting of 101 year old stand (10 Pine +oak, Hav. – 32 м, D av. – 40 см, M – 520 $м^3 \cdot га^{-1}$, N – 295 trees per ha, C_2GDS)

Dynamics of appearance and development of natural regeneration of pine on this object presented in the Table 4.

Table 4 – Dynamics of pine natural regeneration development

Year, Inventory season	***Number of forest natural regeneration, thousands / ha $^{-1}$:***			
	1-year old	***2-years old***	***3-years old and older***	***Together***
2011, spring	36,9	5,7	0,8	43,4
2011, autumn	20,4	16,1	3,5	40,0
2012, autumn	4,9	17,4	4,9	27,2

A lot of 1-3 year old satisfactory natural regeneration of pine on the research area during 3 years after cutting I indicates its sufficient to form on the area high competitiveness stand with dominating in its composition main forest form specie. The presence in the area of research of similar silvicultural featured sites is direct evidence of the real possibility of a significant increasing in the proportion of area Polesse natural young growth pine areas.

Interesting both from the academic and scientific viewpoints are objects established within 2011-2012 years Plesetsk forestry workers together with scientists of the department. This primarily concerns polishahovyh crops in the C3 conditions (Fig.) and a number of Scots pine forest crops with larch created in various schemes of mixing breeds.

1 2 3 4 5 6 7 8 9 10

А	Pine	Cherry	Spruce	Larch	Oak	Birch	Lime	maple	Hornbeam	Querc. pub.
Б	Cherry	Larch	Birch	Maple	Qurc.Pub.	Pine	Spruce	Oak	Lime	Hornbeam
В	Spruce	Birch	Hornbean	Pine	Larch	Lime	Qeurc.pub.	Cherry	Oak	Maple
Г	Larch	Maple	Pine	Oak	Hornbeam	Cherry	Birch	Querc,pub	Spruce	Lime
Д	Oak	Quearc.puc	Larch	Hornbeam	Spruce	Maple	Cherry	Lime	Pine	Birch
Е	Birch	Pine	Lime	Cherry	Maple	Spruce	Hornbeam	Larch	Qurrc. pub	Oak
К	Lime	Spruce	Querc.pub	Birch	Cherry	Hornbeam	Oak	Pine	Maple	Larch
Л	Maple	Oak	Cherry	Quec.pub	Lime	Larch	Pine	Horbe	Birch	Spruce
М	Hornbeam	Lime	Oak	Spruce	Pine	Querc. pub	Maple	Birch	Larch	Cherry
Н	Querc pub.	Hornbeam	Maple	Lime	Birch	Oak	Larch	Spruce	Cherry	Pine

Fig. Schemes of tree species placement in полішахових forest crops in C2 conditions. (Plesetske forestry, 3-5 sections in block № 93, Type of Site Conditions - C2 with pine-oak composition, area- 1ha.)

It is equally important for the forest crop heritage the collection of poplar clones on the educational nursery of the department and laid with their participation experiential and industrial plantation of forest crops (Boyarka forestry, block…., area…)[21], and researches of the department about “seedling hospitalization” which were started by B.E.Shmidt [23] and continued using modern materials. [11]. Last is a prime example of the use and further development of forest crop planting heritage by grateful students.

It is difficult to overestimate the value of the forest crop heritage objects for educational and training work, for conduction fundamental and applied research, test working hypotheses and test the results of scientific research university employees. That is why nowadays very important to concentrate attention on the

support of the existing objects of great value, and lay new stationary objects, taking into account global and regional challenges.

First of all , having past experience , it is advisable to increase the share and value of created complexes , interdepartmental research projects. In order to provide a systematic approach to this important area of work , it is imperative to develop a position on the order of laying , care and effective use of research facilities and by departments and scientific part of Boyarka Forest Research Center.

To intensify the teaching and learning of the students in the Institute, together with the laying of the objects in the forest fund of Boyarka Forest Research Center, departments should activate creation of educational - scientific silvicultural, reclamation, ecological and biological stationary in the forests near the University and in the Botanical garden , such as training and experimental nursery and unique plants and watercourses pre- and postwar years.

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