The indices of survival and preservation ability of the common oak forest crops developed from the saplings with containerized (the experiment) and non-containerized (the control) root system in the State Enterprise Chuguev-Babchansk Forestry Area and the State Enterprise Vovchansk Forestry Area of Kharkiv Regional Forestry and Hunting Department were investigated.

The survival and preservation ability of the common oak saplings in experimental variants considerably exceeded the control during all years of the research.

***The common oak, planting material with containerized root system, survival ability, preservation ability**.*

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WAYS TO IMPROVE AND INCREASE THE STABILITY DEVELOPED FOREST PLANTATIONS

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This study demonstrates reforestation in Ukraine through the experiences of deterioration factors in man-made plantations and discusses theleading ways to increase the value of these forestsand their biological stability.

Reproduction of forest planting stock, survival rate, survival, progeny.

The deterioration of forest health with increasing human impacts and climate change necessitates the development of new approaches and technologies for both afforestation and artificial reforestation. Currently the main objectivesare to preserve existing forests, expand thereproductive potential and enrich the biodiversity of forest ecosystems. it is for these extremely important reasons that that the silvicultural techniques be applied with environmentally-oriented technologies that take into account the nature of forest stands that are aimed at improving the quality and increasing the stability developed plantations.

Objectives: This study **s**ummarizes the experiences of restoration of forests in Ukraine. It alsoidentifies the factors that have contributed to the deteriorating quality and condition of these plantations and highlights the main ways to increase their Forestry value and biological stability.

Results. One of the key indicators of the quality and effectiveness of integrated silvicultural activities (including activities related to the provision of seedand cultivation of plant material), is the survival rate of planted woody plants in artificial plantations.

Research has found that the survival rate of forest plantations established on forestland,irrespective of the regionare 4-5% higher than on theprotective forest plantations subjected to the processes of afforestation(Table1).

Table 1.Survival rateof forest plantations established in 2009-2011 (according to the State Forestry Agency of Ukraine, 2012)

Region	Survival Rate, %					
	Standard	Actual	Standard	Actual	Standard	Actual
	2009		2010		2011	
Reforestation						
Polissia	85,4	87,9	91,0	91,4	91,0	91,6
Forest-Steppe	81,1	82,9	86,0	87,0	85,6	86,9
Steppe	70,6	67,1	72,6	64,9	71,9	66,4
Carpathians	90,0	90,3	92,6	92,0	92,6	92,5
Total	83,5	84,8	88,2	88,3	87,9	88,3
Afforestation						
Polissia	80,5	84,0	86,2	87,3	86,3	88,6
Forest-Steppe	76,0	78,7	80,5	82,2	80,8	83,0
Steppe	67,7	61,4	70,7	62,8	70,6	65,8
Carpathians	85,0	88,0	88,0	90,2	88,0	91,2
Total	71,4	68,6	73,5	68,0	72,9	69,6

Despite the fact that in recent years there is a noticeable trend of increasing survival rate of forest plantations, the actual survival rate of seedlings in artificial stands in steppe regions forboth afforestation and reforestation is lower than expected.

Given the regional characteristics of distribution and the volume of afforestation stipulated in the national target program "Forests of Ukraine" on the 2010 - 2015 biennium, it is noteworthy to observe the data inventory of forest plantations established during 2008-2010 zones (Table 2).

Table 2.The inventory of forest plantations established in the forests of the State Forestry Committee of Ukraine in 2008-2010

Region	Developed Forest, ha	Did not Survive Forest		Requires Completion	
		ha	%	ha	%
Polissia	37463	20	0,1	6534	17,5
Forest-Steppe	42757	195	0,5	12331	29,2
Steppe	65473	8186	14,4	22144	45,4
Carpathians	14768	9	0,1	1107	7,5
Total for three years	160461	8410	5,3	42116	29,5

Based on the data from these 3 years, the Steppewhich have the most arid conditions, had the greatest amount of plantation forest land about 40% (65.5 thousand ha) and lowest - 14.8 thousand hectares or about 10% the Carpathians. In the steppe, which require the most intensive silvicultural

intervention, in some years, 10 to 18% of planted forest do not survive. One of the root causes of this mortality is the that the seedlings are planted in specific time periods of about 3-5 days which may not be the most optimal time of the year in this more arid climate.

Another equally important significant mortality factor is to use only seedlings with an open root system. The survival rate for these is small in areas with insufficient moisture, even if planted in the most favorable time of the year.

Planting in arid conditions necessitates an increase in the proportion of Steppe adapted seedlings with closed (not damaged) root system of intact and root to leaf proportions. Use of these plants in the Steppe and Forest-Steppe of the southern regions will not only greatly reduce the risk of loss of crops, but also significantly reduce the need for replacement seedlings.

Our findings have shown that the forestswere significantly affectedby the weather conditions in the 3 year period of the study. (Table 3). In the drier years of 2008 and 2010, with especially long spring and summer droughts, the proportion of crop mortality in the steppe regions exceeded 30%.

Table 3. The area of forest plantations, which did not surviveduring the years 2008-2010 (according to the State Forestry Agency of Ukraine, 2011)

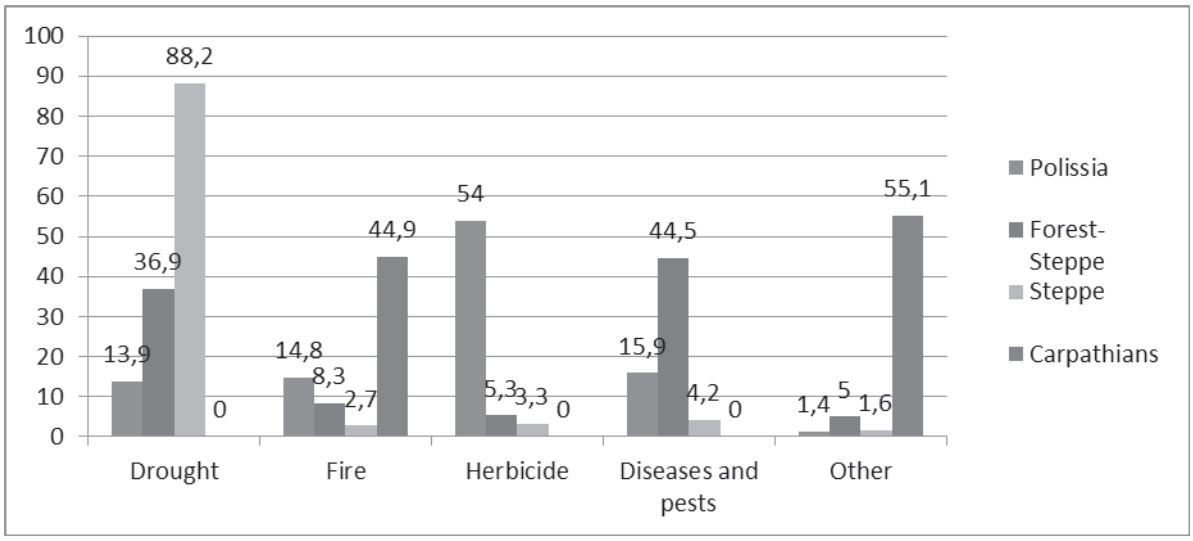
Region	2008		2009		2010	
	ha	%	ha	%	ha	%
Polissia	67	0,3	169	1,0	71	0,5
Forest-Steppe	714	4,3	434	2,5	246	1,8
Steppe	7478	36,9	4151	16,7	9158	38,1
Total	8259		4754		9475	

Research has revealed patterns of a larger proportion of deaths between one year seedlings(excluding two or three year old seedlings and protective plantations), compared with plantings in areas with forest ecosystem features (Table 3). The main causes of death for the one year seedlings is their low quality and the more extreme conditions (absence of properties which are more natural-like forest ecosystems, soil degradation, etc.) in newly forested sites.

Overall causes of crop deathin forest plantations, are tmost due to the various factors shown in Graph 1.The main factor leading to mortality in drier forest regionsis drought. It accounts for almost 90% of deaths in 1 - 2 year old plants. In the forest-steppe of the main causes of mortality are pathogens (over 40%) and pests (about 40%). The Polissia region has herbicides (over 50%) as the leading cause of death, and in the Carpathians the chief mortality factor is fires (45%).

However, even in particularly dry periods in early spring and long summer droughts in some years, the annual death rate of the crops which average more than 13% is not acceptable. This mortality rate is not only a waste of money and material resources but also diminishes the reputation of

forestry professionals and lowers the potential value for newly forested areas and a loss of forest product [3].



The main causes of death in forest plantations in 2009 (according to the State Forestry Agency of Ukraine, 2010)

Our research has found that the main factors that cause low survival ratesare:

- Poor quality of planting material (use of seedlings with significantly impaired root to leaf proportions with unfinished growth processes such as lacking the existing terminal bud)
- Planting forest crops in non optimal agronomic conditions in spring;
- Using tree species that are not properly adapted to growing conditions of their the forest plantations outside of their preferred areas(e.g. planting varieties that are adapted to the Carpathians in steppe regions that are drier and warmer);
- Irregularities in the processes for planting seedlings in silvicultural areas (such as drying and death of root hairs and physiologically active roots, root bending, insufficient tightening of root systems in propagating cracks)
- Low proportion of plant material with closed root system and mycorrhizaed seedlings of crops in areas with extreme conditions (Steppe conditions in areas with no natural forest ecosystems).

To solve these problems (increasing survival rate of seedlings and lengthening the duration of crop planting), it may be necessary to use plant materials with closed root systems which in Ukraine in contrast to developed countries is not yet commonly produced. To ease the challenges of the drawbacks mentioned, our studies have revealed that using plant material with an open root systems are preferred. The basis of the patented utility model [2, 4] is a specific rearing technique (used in healing and preparation for planting) for seedlings with open (injured) root system to regenerate the damaged roots in rolls of agrofibre with a specially prepared substrate and to help achieve the proper root to leaf proportions.

This technique allows not only the recovery of seedlings to restore proper root to leaf proportions and those disturbed during planting excavation [1, 5], but also, significantly increases the survival rate of pineseedlings specifically and lengthening the duration of crop plantingin permanent plantations (Table 4).

Table 4. Main characteristics of root and aerial parts of pine seedlings with three planting preparation methods

Methods of seedling preparation	Planting Date 15.06.2012		Planting Date 18.07.2012		Planting Date 16.08.2012	
	Mass, g Root System / Aerial Parts	Ratio of Root System/ Aerial Parts	Mass, g Root System / Aerial Parts	Ratio of Root System/ Aerial Parts	Mass, g Root System / Aerial Parts	Ratio of Root System/ Aerial Parts
Excavation and recovery	0,85±0,101 / 3,40±0,420	0,25	1,35±0,206 / 4,32±0,349	0,31	2,07±0,323 / 5,44±0,640	0,38
Digging and planting	1,27±0,238 / 12,88±1,917	0,10	1,59±0,316 / 11,32±1,268	0,14	2,03±0,289 / 11,32±1,268	0,17
Planting and loosely covered with earth	0,89±0,131 / 4,95±0,682	0,18	0,93±0,083 / 6,15±0,737	0,15	0,96±0,094 / 6,83±0,993	0,14

The data from Table 4 illustrates the most favorable ratio in recovered seedlings of the mass of the root system to the aerial parts. In comparing the ratios of root system and the aerial part of seedlings traditionally grown in the open ground and recovered seedlings, the ratios of traditionally grown seedlings are worse due to greater woodiness and degeneration of water circulation.

The use of patented utility model in planting seedlings affects the adaptive capacity of plants. Research has established a relatively high survival rate of Scots pine (75.5-83.0%), in harsh weather conditions, in optimal agronomic planting times with traditional planting material i.e. seedlings with an open root systems (Table 5).

We have determined that the relatively high survival rate of normally rooted seedlings planted during optimal agronomic time period is due to the significant amounts of moisture in the soil at the beginning of the growing season after a heavy winter snowfall. There was a higher survival rate of recovered seedlings planted in July compared to those of May and June. This was due to several days of heavy rains immediately after the summer planting compared with lower drier conditions in May and June.

Survival rate of recoveredseedlings with optimized root to leaf ratio (regardless of the planting time) was 1.5-2 times higher than the normally rooted seedlings with an open root system.

Table 5.Survival rate of pine seedlings with an open root system (ORS) and recoveries in newly harvested lands for 2010 (Boyarske Forestry, Quarter 103, Forest Site Type - newly harvested lands)

Option planting	Planting season	Type of planting material	Survival Rateof seedlings, %		
			July 7	August 11	October 15
Control	April 14	ORS	83.5	77.0	75.5
Late-Spring,	May 20	Recoveries,5weeks	72.0	57.0	50.0
Control		ORS	41.0	28.5	21.0
Early-	June 15	Recoveries,8weeks	75.0	59.0	50.5
Summer,		ORS	64.0	42.0	30.0
Control					
Summer,	July 7	Recoveries,11weeks	-	68.0	54.5
Control		ORS	-	59.0	34.0

Conclusion

Past studies suggest the following conclusions on the main trends and ways to improve the survival rate and preservation of forest plantations. One of these ways is not approving the development of forest plantations (especially in the arid steppe conditions) during non-optimal agronomic time periods. To minimize unfavorable outcomes, the best silvicultural practices are to plant seedlings in autumn, especially in the regions of Steppe and the southern regions of Forest-Steppe.

Another way to improve survival rates and preserve existing forests is to increase the proportion of recovered seedlings (with proper ratios between the masses of the root system and aerial parts) and mycorrhizaed planting stock for afforestation.

The most effective and scientifically proven method for preparing seedlings before planting is the use of modern growth substances incorporating moisture storage.

It is extremely important in the establishment of forest plantations in extreme conditions to only use seedlings and saplings with closed root system. This does not apply to the use of homemade grown plant material (such as in plastic bags, cups, "pills", and seedlingsof English oak and others species that have a taproot). This primarily refers to seedlings and saplings grown using industrial methods, automated lines and modern vessels.

For these changes to occur, improvements need to take place in Ukraine's 5-7 regional nursery facilities (such as those that exist in Poland, Belarus and other nations) with the relevant requirements of equipment and time frames (Pollisia has 1-2 facilities; the Carpathians and Western Forest-Steppehave 1; the right-and left-bank Forest-Steppe have 2; and Steppe has 2-3).

Such an approach would, in addition to almost achievinga 100% survival rate of forest crops, more efficiently use improved seedlingswith beneficial hereditary features (which we use today but not very commonly or effectively) and facilitate the production of mycorrhizaed PM forest-forming species (for afforestation and forest restoration).

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Узагальнено досвід відтворення лісів у країні. Охарактеризовано чинники погіршення стану створюваних насаджень. Наведено головні шляхи підвищення їх лісівничої цінності та біологічної стійкості.

Відтворення лісів, садивний матеріал, приживлюваність, збереженість, лісові культури.

Обобщен опыт воспроизводства лесов в стране. Охарактеризованы факторы ухудшения состояния создаваемых насаждений. Приведены главные пути повышения их лесоводческой ценности и биологической устойчивости.

Воспроизводство лесов, посадочный материал, приживаемость, сохранность, лесные культуры.

УДК 631.461: 630.233

ДО ПИТАННЯ ВПЛИВУ РЕКРЕАЦІЙНИХ НАВАНТАЖЕНЬ НА ВМІСТ ОСНОВНИХ ЕЛЕМЕНТІВ МІНЕРАЛЬНОГО ЖИВЛЕННЯ У ДЕРНОВО-ШАРУВАТИХ ГРУНТАХ

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Показано, що у верхньому півметровому прошарку дерново-шаруватих ґрунтів під впливом рекреаційних навантажень зменшується

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