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INDUSTRIAL FORESTS GROWTH ON CHESTNUT SOILS OF DRY STEPPE ZONE ON THE EUROPEAN TERRITORY OF RUSSIA

The article presents materials on assessment of the growth and the current state of massive petiolate oak trees in dry steppe, their dependence on the soil and climate, silvicultural factors. The ways of increasing their durability and drainage efficiency are offered here.

Keywords: oak woods of industrial value, growth, condition, durability.

In October, 20, 1948 the Council of Ministers of the Union of Soviet Socialist Republics and the Central Committee of the All-Union Communist Party (Bolsheviks) adopted a resolution "On the plan of field-protecting forest plantations...", that got the popularly as "Stalin's plan to transform nature". Later, in addition to this plan, the government adopted a decision on June, 17, 1949 "On creation of the oak forests of industrial value on the right bank of the Volga in the areas of Stalingrad and Astrakhan regions and areas of the Don and the Manych of Rostov region", according to this paper it was planned to create 407 thousand hectares (137, 100 and 170 thousand ha, respectively) of massive petiolate oak trees as a source of local commodity wood in forestry deficiency regions in the country during the period of 1950–1955 (after that commercial oak woods were grown also in Stavropol). Difficult for afforestation soil and climatic conditions and lack of proper agricultural and silvicultural care caused massive loss of young plants. According to some data by 1956 some over 15% of oak trees remained [5], so survived till nowadays rare fragments of such plantations have important cognitive and scientific significance.

The purpose of research is to study the effect on the state, productivity and longevity of petiolate oak trees plantations soil and climatic, silvicultural factors. In 2011 the massif of petiolate oak trees was studied (tract "Gromoslavskij oak wood") and state forest shelter-belt Voronezh-Rostov-on-Don in the October district of the Volgograd region (Table 1). The study area belongs to the subzone of sagebrush-cereal desert steppe with the domination of chestnut soils of heavy gradation and various kinds of solonetzicity. In lowering zones meadow chestnut deep solonetzicity soils have been formed. The climate is continental and dry. Annual rainfall is 300-350 mm, evaporation is 700-750 mm. Subsoil waters are on the roots achievable depth. [6]

"Gromoslavskij oak wood" (over 200 ha) is located in the watershed

Table 1

Taxation characteristics of plantations "commercial oak woods" and state forest belt on chestnut soil dry steppe

№	Soil, type of vegetation location conditions	Kind type	Age years	Height Average, m	Diameter, average, m	Growth class	Width	The number of trees per hectare	Forest yield, m^3/ha
Tract "Gromoslavskij oak wood" (New Aksay district forestry of Svetloyarskiy forestry in Volgograd region)									
1	Meadow chestnut light clay, D_2	10O	59	14,0	24,7	III	1,1	546	186
2	Chestnut Light clay, D_1	10O	59	8,4	15,2	V	0,6	695	63
3	Meadow chestnut Heavy loamy, D_{1-2}	10O	59	11,0	18,2	IV	1,1	917	147
4	Chestnut Middle loamy, D_{1-2}	I woody deck 10O II woody deck T, R	59 –	9,0 1,5-2,5	16,4 –	V –	0,5 1,0	491 2500	52 –
State forest shelter-belt Voronezh-Rostov-on-Don (New Aksay district forestry of Svetloyarskiy forestry in Volgograd region)									
5	Meadow chestnut light clay, D_2	9D 1A	45	14,5 10,6	19,3 13,5	II III	0,9	729 1303	160 80

of rivers Aksai and Myshkova near the village Gromoslavka. Oaks were planted in 1952 by acorns drill sowing with the row spacing of 6 m. For many years mechanized agrotechnical care was carried out there. But improvement felling started from 17-years age [1, 2].

At present time the stand state is weakened everywhere (Fig. 1). Its best sections were preserved fragmentary in micro-lowerings having additional moisture at the expense of flowing water from the catchment area and the high fertility of soils (meadow chestnut soils with the level of carbonate horizon deposition more than 1 m). In such conditions to 59 years large stocked (in lines) clumps of oak with an average height of 11,0-14,0 m, average diameter of 18,0-25,0 cm and stem wood supply of 150-190 m^3/ha formed (Table 1, sampling areas 1 and 3). However, signs of decay are found here. Closeness between the rows of trees does not exceed 0.5-0.6. 17-54% of the trees have healthy appearance and wide natural crowns, 46-83% of them are actively die-back or dried out. Agrotechnical care stoppage in wide iterrows led to the development of luxuriant grass, in relief depressions with intrazonal soils led to the growing of xero-mesophytic native shrubs in them (blackthorn, buckthorn). It has a negative impact on the water balance of the stand, accelerated its aging. Wide interrows and constant care in them promoted the formation of large trees, less resistant to a sharp deterioration of the water regime of the steppe soils. The planting life extension can be exchanged it in the stem ones with optional renewal of agricultural and silvicultural care.

Figure 1. 59-year-old oaks with a 6-meters long interrows in the meadow-chestnut (A) zonal chestnut (B) soils in the dry steppe. "Gromoslavskij oak wood". August, 2011

Stands regularly bear fruit, which can be seen on a fairly frequent occurrence in rows (300-500 specimen on 1 ha) mixed-age self-seeding oaks and underwood. Its distribution over the area is uneven (from individual to group, on a heavily sodding areas it is absent), but the condition is relatively trustworthy (height 0.3-0.8 m).

In a less favorable soil conditions (Table 1, sample areas 2 and 4) – on level areas with complex solonetzic soils – stands decay is occurred on even more accelerated rate. Healthy trees are almost lost, the amount of die-back trees is of 32-62%, dried out trees are of 32-67%. Stock of low-tradable stem wood is 50-60 m^3/ha. Underwood is practically nonexistent. On elevated areas and stained solonetzes oak loss occurred at a young age. [1] An already bad sanitary situation in these plantations is worsened by the recent increase in cases of fire, increasing the area of sparse stand and glades (Fig. 2). The futility of them (plantations) of any forest management activities is obvious. These stands cannot be saved even "landing on the stump," based on the stool next generation.

On the chestnut soils of the dry steppe in the plants with wide interrows and long agrotechnical care, apparently, even with timely optimization of stand density, the successful growth of the oak seed generation is provided only up to 35-45 years. After that they should be cut down in order to gain coppice generation or replaced with new cultures.

Growth and plants conditions in the meadow chestnut soil reduction are encouraging (similar to the sample area 1 soil and climatic conditions) in the state forest shelter-belt Voronezh-Rostov-on-Don on mixing of the two paired rows

of oaks (in 1,5 m) with one row (in 3 m) of ash-trees (Table 1, sample area 5). At the age of 45, it retains a large enough density, healthy appearance (Fig. 3), reaching the height of 15-16 m, with an average diameter of about 20 cm and stem wood of good marketability – 160 m^3/ha. Drop out of oaks is almost exclusively due to growth patterns of small-diameter trees. Rows of ash-trees were thinned out about 20 years ago. Stumps of felled trees successfully resumed and the best stem woods are almost equal to the height of the seed ones. But ash-trees are behind the oaks in the growth of 1-2 m, their stems are inclined to the side of interrows. Severely oppressed trees (also mostly from the upper diameter classes) have a thick low young plants at the base. In the plantation the forest is preserved – high closed tops, no living ground cover, there is a multi-age thick ash-trees undergwood of 0.5-3 m high and oaks (rare clumps) are of 0.3-2 m high.

The current state and development of oaks allow to predict the longevity of this plantation at least for 60 years. It is possible to improve the moisture content of oaks by thinning. If necessary, with the use of low-cost reafforestation thinning and care of underwood, this plantation can also be successfully replaced by steady stem-seed oak-ash-trees generation.

The results of forest researches on plantations of "commercial oak woods" clearly confirm the conclusion that in the dry steppe and semi-desert conditions it is not possible to grow resistant durable oak stands without careful selection of areas, pre-plant soil cultivation, application of the special system of silvicultural and agricultural techniques. Wide interrows and long agrotechnical care promote the formation of large trees with branchy crowns, less resistant to a sharp deterioration of the water regime. After the stoppage of soil cultivation the soil is quickly covered by prairie grasses or shrubs, and trees stand stops its growth and gradually decays. On intrazonal ("dark") soils of lowerings mixed on wood type oak stands with its original predominance in the wide row spacing up to 3 meters, where water content for the main species can be controlled by the partial

Figure 2. Glade formed by the early drying stand and damaging by the fire. "Gromoslavskij oak wood". August, 2011

Figure 3. An oak-ash-trees stands on meadow chestnut light clay soils in the state forest shelter-belt Voronezh-Rostov-on-Don. August, 2011

cutting of the given type trees, have increased durability. The use of shrubs to create such trees is not advisable due to the high competitiveness for the moisture. Pure stands with 2-3-meter interrows after closing tops ensured by the timely cleaning and thinning, not destroying the forest, are seemed to be more stable. At the zonal complex sagebrush-cereal desert steppe soils coulisse planting and massive reclamation forest plantations should be set up from the large and medium shrubs with small amounts of xerophytic species of wild fruit trees having increased functional longevity and ability to renew by seeds and vegetative methods in these conditions [3, 4].

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