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Black Locust (*Robinia pseudoacacia* L.) in Bulgaria

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Abstract : *Robinia pseudoacacia* is one of most widely cultivated exotic species in Bulgaria. The total area of black locust plantations amounts to 2.9% of the total forest area of the country. 15.34% of the plantations are of management afforestations category, where the priority is given to timber production. They have been created on rich and moisture soils, which are the most appropriate for the species in order to achieve its biological potentials of high productivity. The rest of the available plantations in the country are planted on poorer and drier soils up to 600~800 m altitude. The high adaptive ability of the species to unsuitable environmental conditions as well as the high sprout potential was used for their creation. These stands are mainly done with the aim to protect and ameliorate damaged environments and production of small-size timber and fire woods. They are cultivated until 15-20 years and are revived by sprouts. Therefore the management goals searched, 45.69% of those forests are low productive and 38.97% with average productiveness. The present report deals with growth and productivity capacity of black locust plantations; production of sowing materials; production of reproductive and vegetative saplings for afforestation; the technological aspects of afforestation works; the management and use of black locust plantations as well as some more important diseases and pests affecting the species. The report is entirely based on Bulgarian scientific research works and experience with the *Robinia preudoacacia*. Recommendations for optimizing the use of species are given.

Key words **:** *black locust, Bulgaria, copies,* Robinia pseudoacacia, *sapling production*

Introduction

To clarify the importance of black locust it is necessary to present some most general information about the forests in Bulgaria. The forest land area is 3,914,000 ha which is 34% of the total area of the country. The forested area is 3,398,000 ha or 86.5% of the forest land. The total growing stock is 526 million m^3, and the mean growing stock 156 m^3/ha. The annual increment is 12.3 million m^3, and the timber harvested 4.6 million m^3. The average age of the forests is 49 years. The distribution of forests by forest type in Bulgaria is shown in Table 1.

The coniferous forests are found mainly in semi-mountainous and mountainous areas over 600 m in altitude which represent around 34.7% of the territory of Bulgaria. About 1.8 million ha of these have been afforestated. The share of the broadleaved forests is the most significant. This is due to the fact that about 65.3% of the territory of Bulgaria is lowlands and foothill regions up to 600 m in altitude. The broadleaved forests are extremely diverse with regard to growth conditions, species composition, silvicultural characteristics and economic indices.

The broadleaved high forests are of the greatest economic value. However, considering their growth potential and health status, a significant part of the coppice forests can be transformed into forests of seedling origin. The forests for reconstruction are to undergo a complete or partial change in the species composition in order to achieve the most successful realization of their multiple functions and importance. The smallest proportion of forests is managed as low-stem. A significant part of the black locust stands belong to this forest type. Black

Table 1. Distribution of forests by forest type in Bulgaria.

Forest Type	% of total forested area
Coniferous Forests	32.7
Broadleaved High Forests	22.0
Forests for Reconstruction	18.3
Coppice for conversion	23.8
Low-stem Forests	3.2

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locust was introduced into Central and Southern Europe in 1638. In Bulgaria the attention of the silvicultural research was focused on the species as early as the end of the 19th century (Stefanov and Gantshev, 1958).

The significance of black locust for the Bulgarian economy has been highlighted by a number of researchers (Petrov, 1913; Stoyanov, 1926; Penev, 1939; Atanasow, 1956; Petrov and Prokopiev, 1962) and can be summarized as follows:

1. As a very fast-growing species (Dobrev and Bodjakov, 1971) black locust reduces the timber production cycle several times (Stoyanov, 1926; Penev, 1937).

2. Black locust wood has very good physical and mechanical properties (Petrov and Kavalov, 1988); it does not rot in water and therefore it is used for grapestakes, sleepers, mine props and etc. (Enchev, 1955). It can be successfully used in manufacturing furniture (Kavalov and Petrov, 1987; Petrov and Kavalov, 1988).

3. It is used for improving the soil nitrogen reserves (Aleksandrova *et al.* 1994; Broshtilova *et al.*, 1993; Stoyanova, 1995; Georgiev *et al.*, 1991, 1992, 1993, 1995, 1996, 1997).

4. This species is one of the most commonly used melliferous plants in Bulgaria (Kalmukov, 2000; Milev *et al.*, 2004).

5. It is one of the tree species most commonly used for firewood.

6. Because of its fast growth, its ability to grow in poor soil, its drought tolerance, its ability to produce numerous root suckers and its well-developed root system, it is used for preventing erosion on steep terrain and damaged soil (Stoyanov, 1926; Penev, 1937; Kostov and Tashev, 1956; Kalmukov, 2000; Tzakov and Dimitrova, 2001, 2003). However, it should be noted that it does not realize its potential for vigorous growth in poor and dry sites.

7. It is used in the reconstruction of forests of small value in Bulgaria (Georgiev, 1965a; Donchev, 1975; Gencheva and Zheleva, 1983; Gencheva *et al.*, 1986a,b, 1989, 1993; High *et al.*, 1994, 1995; Aleksandrov *et al.*, 2001a,b, 2002).

8. The black locust could be used for afforestation of industrial regions with pollution (Prokopiev, 1978; Jotsova-Baurenska *et al.*, 1985; Lazarova, 1989; Georgiev and Kalmukov, 1996; Tsakov, 2000, 2001).

9. It is appropriate for protective forest belts creation (Mihailov, 1955).

10. It is used in tree compositions in gardens and parks, and along roads.

Black locust is one of the most widely cultivated species introduced into Bulgaria and it occupies 2.9% of the forested area of the country. It is grown in the lower forest zone throughout the country (from 900 to 1000 m in altitude) (Zahariev *et al.*, 1979). As in other countries black locust is often planted in sites different from its natural habitat, and the diverse environmental conditions account for its great variability. For intensive wood production certain peculiarities of the climate of the species country of origin should be taken into consideration: lowest monthly temperatures in January from -4°C to 7°C; highest monthly temperatures in August from 18°C to 27°C; frost-free period from 150 to 210 days; yearly precipitation from 1,020 mm to 1,830 mm; total annual snow cover 5-152 cm (Milev *et al.*, 2004). It should be noted that black locust is very sensitive to frost and wet snow. Very negative consequences can result from iron deficiency in the soil (Zahariev *et al.*, 1983; Yurukov, 2003).

The age structure of black locust forests is shown in Table 2. As it illustrates the main part of the stands are harvested on a short rotation-up to 25 years, and the share of stands over 61 years is insignificant. The main

Table 2. Distribution of black locust forests by age class and ownership.

Age / Owner	Total (ha)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	over 61
Total	110846	25515	20226	17258	16608	9665	6684	5765	5690	2585	540	128	94	88
SFL	89075	22697	15467	13255	13613	6719	5303	4493	4692	2106	430	123	93	84
AL	344	139	90	25	16	33	29	11	1	-	-	-	-	-
TFE	8	-	-	-	-	-	2	3	1	1	1	-	-	-
MFL	5621	798	1108	987	761	652	347	270	479	167	46	2	1	3
FOI	15277	1845	3484	2902	2148	2204	968	925	469	299	31	2	-	-
FOPLE	220	25	15	53	30	38	7	26	-	1	25	-	-	-
FOC	285	11	62	34	40	19	28	30	48	7	4	1	-	1
MEW	16	-	-	2	-	-	-	7	-	4	3	-	-	-

Legend: SFL – state forest land, AL – agricultural land, TFE – training forest enterprises, MFL – municipal forest land, FOI – forests owned by individuals, FOPLE – forests owned by private legal entities, FOC. – forests owned by churches, MEW – land managed by the Ministry of Environment and Water

Table 3. Distribution of black locust timber by age class and ownership.

Age Class	Total (m^3)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	over 61	Over story
Total	6038948	296548	695099	972856	1211106	859366	640236	477400	560590	254958	44092	12418	7506	6078	695
SFL	4861765	264188	558217	784854	1013296	617551	498701	369863	471709	223059	34919	11725	7385	5633	665
AL	7834	430	1950	680	744	1525	1720	640	145	-	-	-	-	-	-
TFE	560	-	-	-	-	-	220	160	90	70	20	-	-	-	-
MFL	315031	8647	33621	55684	54174	48335	29798	24638	40104	14441	5134	121	54	250	30
FOI	834370	22463	100361	129053	141517	188080	108932	77404	47367	16546	1818	567	67	195	-
FOPLE	10650	155	140	1890	1060	3090	560	1970	-	85	1700	-	-	-	-
FOC	6760	665	810	565	315	785	305	1820	1175	300	15	5	-	-	-
MEW	1978	-	-	130	-	-	-	905	-	457	486	-	-	-	-

Table 4. Distribution of black locust forests by site class and ownership.

Site Class / Ownership	Forested Area (ha)	I	II	III	IV	V
For the country	96003	2180	12548	37413	33742	10120
SFL	76359	1830	10613	30199	25963	7754
AL	189	1	40	13	97	38
TFE	2	-	-	-	1	1
MFL	5067	49	354	1837	1990	837
FOI	14013	283	1518	5194	5551	1467
FOPLE	206	1	13	106	77	9
FOC	139	-	6	56	63	14
MEW	28	16	4	8	-	-

owner of black locust forests and investor in the regeneration of black locust plantations is the state.

More than half of the black locust timber is supplied from stands in the 11-25 age range (see Table 3).

According to their productivity the stands in Bulgaria are grouped into 5 site classes (levels of productivity). The analysis of the black locust stand productivity (Table 4) shows that 45.7% of the stands have low productivity, 39.0% have medium productivity and only 15.3% have high productivity. Considering the intensive growth of the species, it can be concluded that in Bulgaria black locust is grown under site conditions different from its environmental optimum. This tendency has resulted from the specific climate of Bulgaria – typically continental, transitional-continental and transitional-Mediterranean – being the basic limiting factor affecting plants, soil and air humidity. Therefore, black locust is planted in dry sites relying on its high tolerance to environmental conditions rather than in moist conditions with an aim of intensive wood increase.

1. Growth and productivity

A number of researchers have studied the growth and productivity of black locust stands in Bulgaria (Georgiev, 1955, 1965a,b; Dimitrova and Tzakov, 2000; Iliev and Petrov, 1967; Kamulkov *et al.*, 1999, Kitin, 1960; Kitin and Slavov, 1964; Broshtilova, 1982; Kostov *et al.*, 1992; Stoyanova, 1995a, 1996; Tzakov, 2003; Tzakov and Dimitrova, 2001, 2003; Tzakov *et al.*, 1995). The adopted models for growth and productivity of black locust forests and black locust coppice forests in Bulgaria are shown in Table 5 and 6 respectively (Nedyalkov *et al.*, 1983).

2. Seed production

As a result from the selection work of the Bulgarian specialists (Dobrinov, 1976; Tsanov *et al.*, 1992) seed orchards and stock plants areas for improved reproductive material have been established in Bulgaria. A 'semperflorens' variety has been also selected. Nineteen seed production plantations with an area of 103 ha located at 100 to 800 m in altitude have been established (Milev *et al.*, 2004).

Black locust starts producing seed at 4-8 years of age, yearly or every other year. The best seed yields are at 15-40 years of age, the significant yields continuing to 60 years of age.

Flowering occurs after leaves appear in April-May. Fruits usually ripens in October, but stays on the tree through the winter. The pods open gradually and seeds disperse over a period of time – mainly in the spring – February-April. They are gathered from October throughout

Table 5. Growth and productivity of black locust forests.

Age/ years	Stands available										Total Productivity		
	Average height/m	Average diameter /cm	Stem number	Basal area/m^2	Stem wood /m^3	Branch-wood /m^3	Growing Stock /m^3	Current Increment /m^3	Mean Increment /m^3	Harvest Volume /m^3	Of a stand /m^3	Total increment /m^3	Mean Increment /m^3
						I Site Class							
5	7.4	5.4	3960	9.1	38	5	43	8.6	8.6	-	43	8.6	8.1
10	13.0	10.2	1950	15.9	101	9	110	18.6	11.0	10	120	15.4	12.0
15	17.0	14.4	1295	21.1	165	12	177	13.4	11.8	25	202	16.4	13.5
20	19.8	17.4	1030	24.5	215	16	231	10.8	11.5	38	269	13.4	13.5
25	21.5	19.8	910	26.6	246	18	264	6.6	10.6	48	312	8.6	12.0
						II Site Class							
5	6.2	4.5	4820	7.7	28	4	32	6.4	6.4	-	32	6.4	6.4
10	11.2	8.5	2420	13.7	75	9	84	10.4	8.4	7	91	11.8	9.1
15	14.7	12.0	1610	18.2	125	10	135	10.2	9.0	19	154	12.6	10.3
20	7.4	14.8	1255	21.6	172	13	185	10.0	9.2	32	217	12.6	10.9
25	19.0	16.5	1100	23.5	200	15	215	6.0	8.6	41	256	7.8	10.2
						III Site Class							
5	5.2	3.8	5750	6.5	21	3	24	4.8	4.8	-	24	4.8	4.8
10	9.4	7.0	3020	11.6	57	7	64	8.0	6.4	5	69	9.0	6.9
15	12.5	9.8	2045	15.4	95	8	103	7.8	6.9	13	116	9.4	7.7
20	15.0	12.3	1565	18.6	130	10	140	7.4	7.0	23	163	9.4	8.2
25	16.5	13.9	1350	20.5	156	12	168	5.6	6.7	31	199	7.2	8.0
						IV Site Class							
5	4.0	3.0	7000	4.9	14	2	16	3.1	3.1	-	16	3.1	3.1
10	7.6	5.5	3905	9.8	39	6	45	5.8	4.5	3	48	6.4	4.8
15	10.4	7.8	2880	12.8	69	7	76	6.2	5.1	9	85	7.4	5.7
20	12.6	9.9	2026	15.6	96	8	104	5.6	5.2	16	120	7.0	6.0
25	14.0	11.3	1730	17.3	114	9	123	3.8	4.9	22	145	5.0	5.8
						V Site Class							
5	3.0	2.2	9200	3.5	9	1	10	2.0	2.0	-	10	2.0	2.0
10	5.8	4.2	5200	7.2	25	4	29	3.8	2.9	2	31	4.2	3.1
15	8.2	5.0	3570	10.0	45	6	51	4.4	3.4	6	57	5.2	3.8
20	10.2	7.6	2775	12.6	66	7	73	4.4	3.6	11	84	5.4	4.2
25	11.5	8.8	2320	14.1	82	8	90	3.4	3.6	16	106	4.4	4.2

the winter until February. Whole fruit clusters or clusters on small twigs are cut; shaking or knocking pods down is also applied (Milev *et al.*, 2004).

After being gathered the pods are left to dry to become more brittle. The seeds are extracted using a special machine for cracking the pods. These are processed twice to achieve better seed extraction. The output varies from 15 to 33%, being 20-25% in most cases. Volume of 1 hl holds fruits weighing 80 kg (Milev *et al.*, 2004).

The weight of 1,000 seeds is 18-20 g, but the range for locally collected seeds being 13-24 g. One kilogram contains 32,000-60,000 (an average of 53,000) seeds. The sowing material moisture is 5-15%. Germination rate is in the range of 50-97% and is successfully preserved for 20 years. The limit for seed viability preservation is 60 years. Sowing material is stored in bags or boxes under dry and cool conditions for a short period and in airtight containers at 0-5°C for a long period (Milev *et al.*, 2004).

Prior to sowing in the spring seeds should be prepared to overcome their dormant state penetrating the hard seed coat. Mechanical and chemical scarification is applied - immersion in concentrated sulfuric acid for 20-50 min (1.6 L of H_2SO_4 per 1 kg of sowing material); the most convenient method is the hydrothermal method – immersing the seeds in boiling water for 3 sec three times with cooling in cold water between immersions (Zahariev, 1965; Velkov, 1970; Iliev and Chavdarov, 1996; Milev *et al.*, 2004).

3. Sapling production

Seedlings. Research results have shown that black

Table 6. Growth and productivity of black locust coppice forests.

Age/ years	Stands available										Total Productivity		
	Average height / m	Average diameter / cm	Stem number	Basal area / m^2	Stem wood / m^3	Branch-wood / m^3	Grow-ing Stock / m^3	Current Incre-ment / m^3	Mean Incre-ment / m^3	Harvest Volume / m^3	Of a stand / m^3	Total incre-ment / m^3	Mean Incre-ment / m^3
						I Site Class							
5	9.6	5.9	4530	12.4	53	6	59	11.8	11.8	-	59	11.8	11.8
10	14.2	11.3	1730	17.3	102	10	112	10.6	11.2	7	119	12.0	11.9
15	17.4	16.2	980	20.2	152	11	163	10.2	10.9	43	206	17.4	13.7
20	19.6	19.8	715	22.0	193	13	206	8.4	10.3	51	257	10.2	12.8
						II Site Class							
5	8.0	4.5	6660	10.6	40	5	45	9.0	9.0	-	45	9.0	9.0
10	11.9	8.6	2580	15.0	75	8	83	7.6	8.3	8	91	9.2	9.1
15	14.7	12.1	1550	17.8	109	10	119	7.2	7.9	19	138	9.4	9.2
20	16.7	14.9	1180	19.7	141	11	152	6.8	7.6	37	189	10.2	9.8
						III Site Class							
5	6.3	3.4	9100	8.2	26	4	30	6.0	6.0	-	30	6.0	6.0
10	9.6	5.9	4530	12.4	53	6	59	5.8	5.9	6	65	7.0	6.5
15	12.0	8.7	2540	15.1	76	8	84	5.0	5.6	11	95	6.0	6.8
20	13.6	10.6	1900	16.7	94	9	103	3.8	5.2	13	116	2.4	5.8
						IV Site Class							
5	4.6	9.6	11390	6.0	15	3	18	3.6	3.6	-	18	3.6	3.6
10	7.3	4.0	7720	9.7	34	5	39	4.2	3.9	2	41	4.6	4.1
15	9.3	5.6	4920	12.1	50	6	56	3.4	3.7	6	62	4.2	4.1
20	10.5	6.9	3610	13.5	60	7	67	2.2	3.3	9	76	2.8	3.8
						V Site Class							
5	3.0	1.8	15000	3.8	9	2	11	2.2	2.2	-	11	2.2	2.2
10	5.0	2.7	11000	6.3	18	3	21	2.0	2.1	-	21	2.0	2.1
15	6.5	3.5	8750	8.4	27	4	31	2.0	2.1	3	34	2.6	2.3
20	7.4	4.0	7650	9.6	35	5	40	1.8	2.0	4	44	2.0	2.2

locust seeds have a high germination rate (Iliev and Chavdarov, 1996). Black locust seedlings are produced mainly in lowland nurseries. Sowing takes place in the late spring to avoid the danger of frosts. Seeds are sown at a depth of 2.5-3.0 cm, and the sowing norm of good quality seeds is 3 g/m^2. On an area of 1 m^2 25-30 seedlings which are over 1 m high are produced. The production cycle is 1 year.

Autovegetatively produced. The possibilities for rooting of cuttings have been studied (Najdenov *et al.*, 1982, 1989; Tsanov *et al.*, 1990; Batov and Kitin, 1993; Kamulkov, 1998; Broshtilov *et al.*, 1998) as well as the *in vitro* propagation (Iliev and Ganchev, 1991; Iliev, 1992).

Propagation through root cuttings is a method used in practice. Roots with a thickness of 6-15 mm which can be stored in closed polyethylene bags in a refrigerator at a temperature of 2-5°C or under natural conditions in wet sand are used.

The cuttings are cut into 7-centemetre-long pieces which are tied into bundles of 25-50 and the morphological upper end is marked appropriately. They are stored in the same way as the root cuttings until sowing. The cuttings are planted vertically after the danger of frosts has passed so that the upper end remains 1 cm below the soil surface (Broshtilov, 1994; Broshtilov *et al.*, 1998).

The planting design depends on the method of mechanical removal of the young trees. After planting the plants are watered. In a year the saplings are over 1 m high.

4. Afforestation

The applied technology for establishment of black locust plantations is a result of many studies (Dobrev and Hristoskov, 1958; Dontshev, 1968; Kostov, 1971; Zahariev *et al.*, 1983; Broshtilov, 2003).

The soil preparation includes stump extraction and ploughing the soil thoroughly to a depth of 25-50 cm. Since the main limiting factor for plant development in the lower forest zone is the soil and air humidity, the soil preparation takes place in the autumn which allows for

optimum soil moisture retention. The afforestation practice involving black locust is carried out by planting the saplings in the spring. One of the methods used is manual planting of 1-year-old, rarely 2-year-old, seedlings in holes drilled by a power tool. The mechanized method involves row planting of rootages. When establishing plantations of black locust the planting design traditionally used is the row plan. The rows are 2-3 m apart, and the plants 1 m apart in the row. This design allows for plant density of 3,300-5,000 rootages per ha.

In few cases, in fertile soils, intensive cultures are established using a more sparse design, for example 3× 3 m, bearing in mind that such low densities result in sideward development of the crown and this requires pruning. In compliance with the existing legal framework cultural practices for young cultures include soil cultivation: 3 times the first year, twice the second year and once the third year. However, considering the fast growth of this species these can be reduced to one soil cultivation in the first year.

5. Forest management

The forest management is realized according the Rules of the thinning in the Republic of Bulgaria forests (Subev *et al.*, 1997). The approach to black locust forest management has been determined by the species characteristics and environmental requirements. In Bulgaria experience has shown that good growth and health are determined by site conditions. In sites with deep to very deep, fresh to humid soil the best growth period is 20-25 years; in sites with medium deep, fresh soil -15-20 years; in shallow, dry or damaged soil -10-12 years. After 2-3 rotations of regeneration felling the plantations become too thin and degraded, and their productivity and resistance dramatically decrease.

Thinning. Black locust plantations are thinned by the low thinning method.

1. *Plantations in fresh and humid sites with deep soil.*

When the plantations reach their second rotation at 10-12 years of age they are thinned to 35% and stocking index of 0.6-0.7. If plantations have been established through selected clones, thinning is carried out depending on their density. When initially planted one stem per sprout is left. At 6-9 years of age plantations are thinned; at 15 years of age they are thinned again to 30% and stock index decrease to 0.7. At the time (15 years of age), the plus trees are selected. They are pruned periodically to form a 4-6 meter-long stem. At any time the crown should not be less than 1/3 of the total height.

If the initial planting design is 3×3 m or less, each tree should be tended. Pruning begins after the third year and continues until a 4-6 meter-long stem is formed.

2. *Plantations in medium deep and shallow soil, and sites with poor moisture retention.* Thinning is not usually carried out in this type of plantations.

Regeneration fellings. Clear-cutting is carried out in black locust plantations. Following coppice re-growth the cutting is carried out outside the vegetative period. The clearing yard site is up to 10 ha, and, on steep and very steep sites - up to 5 ha. In special purpose forests clear-cutting is carried out on small areas of up to 1 ha. The clearing yard enlargement takes place after canopy formation in initial clearing sites.

Loosening the surface soil horizon to break up the root system is carried out, if necessary, after the first rotation in medium rich and rich sites, and it is compulsory after the second rotation. After the third rotation thorough root removal and ground leveling is carried out. The cultivation practices of root removal, root system breakage and leveling are carried out not earlier than 1.5 months before vegetation. Non-regenerated black locust plantations with canopy cover up to 0.5 are uprooted and the areas are afforested with selected black locust clones or other suitable species. If uprooting is not possible, partial soil preparation is carried out.

6. Diseases and pests

Generally speaking black locust is not susceptible to dangerous diseases and insect pests that threaten its propagation (Zlatanov, 1970).

Diseases. More important diseases are powdery mildew or leaf spot caused by fungi such as: *Erisiphe communis* (Wolf.) Link f. *robinae* (Tsch.), *Trichocladia robiniae* (Tsch.). Leaves develop brown spots caused by exogenous development of the mycelia on them, and when severely infected the leaves turn yellow and drop. Control involves the use of sulfur solutions (Zahariev *et al.*, 1983).

Pests. One of the leaf-eating insects that can cause more serious damage is the gypsy moth (*Lymantria dispar* L.). The plantations are treated with 0.15% Agria 59, 0.12% B-58, 0.2% Vofatox and other organophosphorus pesticides (Zahariev *et al.*, 1983).

Significant physiological resistance decrease of the plantations can be caused by the black bean aphid (*Aphis fabae* Scop.) and the European fruit scale (*Eulecanium corni* Bouche.). Effective control measure is spraying with 0.1% Vofatox and 0.2% Agria etc. (Zahariev *et al.*, 1983).

The stems are attacked by the European shot-hole borer (*Xyleborus dispar* L.) and by the goat moth (*Cossus cossus* L.). The young caterpillars are controlled by spraying the infected trees with 0.2% Nogos 50 EC at the end of July and August. The adult caterpillars are controlled by injecting into or directly spraying into the tunnels with 0.5% Fosdrin 50, 0.5% Folidom M-40 and

etc. (Zahariev *et al.*, 1983).

The seed production is susceptible to several insect species which requires regular checks. The most common pest is the locust sawfly (*Eurytoma caraganae* Nik.). The seeds are also attacked by the lima bean pod borer *(Etiella zinckenella* Tr.*)* and locust seed beetles (*Kitorrhinus quadriplagiatus* Mots. and *Bruchus cisti* Fabr.).

Conclusion

The Black locust is one of the exotic species with higher importance for our forestry due the following reasons:

- Easy reproductive and vegetative propagation;
- Possibility to save finances in forestry practice due to low seedling's prime cost within their nursery's production; high percentage of plantations' survival after the planting (even when an unskilled labour was used and a reduction of needed plantation cares is done) as well as the possibility for regeneration by suckers.
- High resistance to pests and illnesses;
- High adaptive ability to wide range of environmental conditions, which give the possibility to use the afforestations for different forestry management goals. The main problem in Bulgaria is the dry growth places on shallow and poor soils up to 600-800 m altitude where the black locust but shows slower growth. On the other hand, the species could be used for intensive production of large-size timber on rich and moist soils;
- It has been proven that the mixed populations with other tree species are with higher productivity and are more resistant to abiotic and biotic factors.
- Speeded up production of fire logs, necessary for the Bulgarian population all over the country.

The following problems should be solved during the management of black locust plantations:

- During the planting process the well known in the country clones should be used. At the same time the introduction and selection of new clones should continue in order to create sufficient vegetative seed orchards, by which the necessities of quality seed material in the country to be covered.
- Development of specialized nurseries for vegetative production of sterile clones should be done in similar way to those for production of poplar planting material.
- Clone collections and experimental plantations should be created by using different clones for comparative analysis of their growth and resistence to various environmental conditions.

The species management is function of the development of the industrial sphere, the economic conditions and timber market in Bulgaria. For the optimization of the management it is necessary to use this species priority in environmental conditions where it could reach its high productivity.

Besides, it is necessary to reduce the plantation reproduction by using their sucker ablity.

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