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11TH HARDWOOD CONFERENCE PROCEEDINGS

Róbert Németh, Christian Hansmann, Holger Militz, Miklós Bak, Mátyás Báder

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Combustion characteristics of Russian olive (*Elaeagnus angustifolia* L.)

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ABSTRACT

The majority of the timber of invasive wood species is used as fuel wood, as it is a forestry objective to control their spread. Knowledge of the higher heating value and ash content are important parameters for the use of wood for energy. In terms of these two parameters, the Russian olive does not lag behind other invasive species. The ash content of its timber is very low, only 2.7%, while its higher heating value is 19.2 MJ/kg. Its ash content is only a quarter of that of black locust, while there is no difference between their higher heating values. The use of Russian olive for energetical purposes is advisable as far as the properties examined are concerned, and it is in no respect inferior to other wood species.

INTRODUCTION

Russian olive is indigenous to the warm continental areas of Asia. It is native to the region starting from the eastern basin of the Mediterranean Sea through Asia Minor, Western and Central Asia, stretching to the Altai Mountains and the Gobi Desert. It is mostly abundant in the Caspian Depression and in the regions of the Aral Sea and Lake Balkhash, where it is a characteristic plant of the vegetation accompanying the watercourses of sandy semi-deserts. It has been cultivated for centuries in Western Asia and Europe, where it has also grown wild and became widely established (Bartha and Csiszár 2012).

In Hungary, it can primarily be found in wet areas. Its spread (Figure 1) significantly changes the subject habitat, and is of outstanding importance in certain parts of the country. It is difficult to remove from anywhere it has once become established. After cutting down, the stump begins to grow new shoots intensively; its roots are capable of binding nitrogen. Its rapid growth also contributes to its intensive propagation. It is often seen along motorways, used as a means of erosion protection and in protective forest bands of ploughfields.

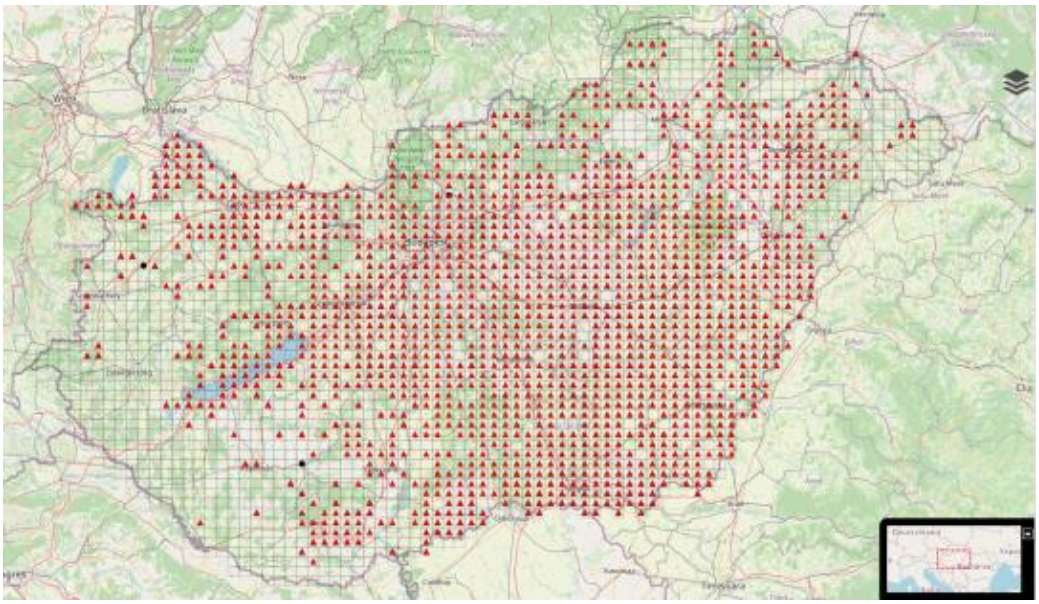

Figure 1: Spread of Russian olive in Hungary (invaziosfajok.hu 2024)

From the apiary perspective, the species gives excellent honey. Its pure monofloral honey has an intensive scent, reminiscent of flower of the tree. It is used as a flavour enhancer in mixed honeys. Its leaves, flowers and fruit rich in vitamin C are also used in folk medicine.
The use of various biomasses for energy is significantly determined by their calorific values, ash contents and other combustion parameters. The timber usually has a lower relative ash content, while that of the bark is significantly higher (Passialis et al. 2008, Nosek et al. 2016, Komán 2018). The noncombustible slag formed during the energy use of biomass raises special operational problems in larger firing plants. This is connected in part to damage caused to the firing equipment, and in part to the deposition of large volumes of ash. These problems can be primarily explained by the presence and the effect of chemical element incorporated into the biomass from the soil during its formation (Komán 2013).
During combustion of solid fuels such as wood, biomass and coal, significant volumes of non-combustible by-products are generated, including ash, slag and minerals. If these ash particles melt and get deposited in the firing equipment, they may hinder optimal heat exchange and flow. Therefore the removal of ash and the reduction of its quantity are of key importance to ensure the efficient and reliable operation of solid fuel firing equipment (Palotás 2011).
One of the key parameters of plantations is the energy yield determined based on higher heating value (Kenney et al. 1990). According to several studies, the bark's calorific value is lower than that of timber (Požgaj et al. 1997, Klašnja and Kopitovič 1999), but opposing opinions can also be found, according to which the bark's calorific value exceeds that of timber by a significant margin (Nurmi 2000).
Russian olive today has no timber industry related significance, primarily being used for firewood. The objective of the current research is to map its energetical characteristics in comparison to other wood species.

MATERIALS AND METHODS

A Russian olive trunk already having mature timber was examined, from a tree that grew in the area of the Fertő-Hanság Basin.
For the tests, 5 cm thick discs cut at the diameter at breast height were used. Ash content test took place on absolute dry samples (Figure 2). Following grinding, a 2 g quantity of the samples were analysed according to the EN ISO 18122:2026 standard, based on 3 samples.
To determine the higher heating value, 1 g pellets were pressed from the wood chips used to examine the timber's ash content (Figure 3). The samples were in absolutely dry condition of which 3 measurements were performed according to the EN ISO 1716:2019 standard.

Figure 2: Sample cross section

Figure 3: Sample of ground bark

RESULTS AND DISCUSSION

Of Russian olive's ash content, it can be said that it is very low in comparison to other wood species. Its ash content in comparison to other invasive wood species is likewise (Figure 3.) very low. Ash contents of tree of heaven, black locust and green ash are 2.5, 4 and 3 times higher than that of Russian olive, respectively.

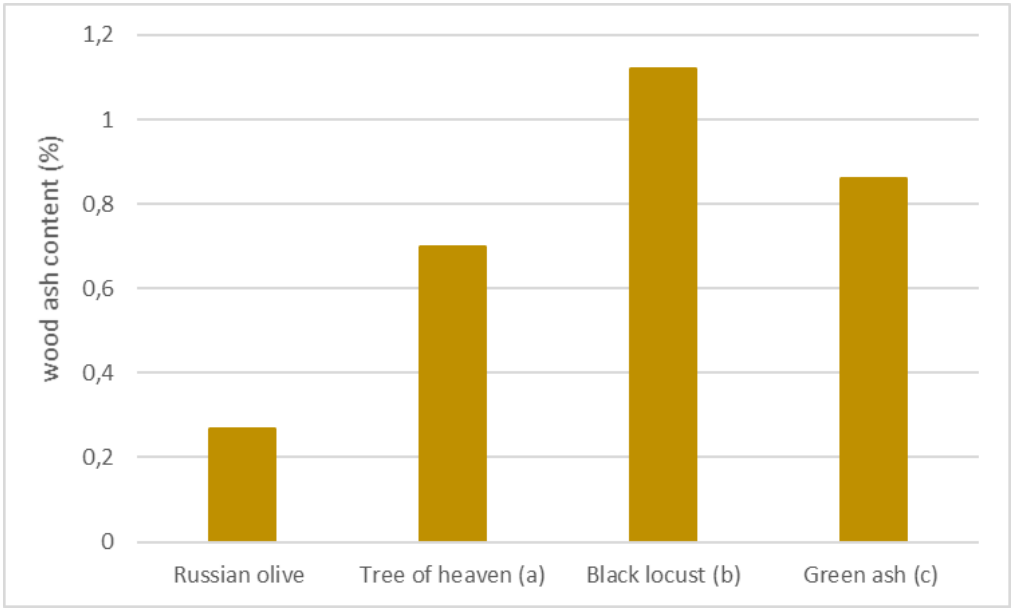

Figure 4: Ash content of Russian olive in comparison to other wood species (a – Terzopoulou and Kamperidou 2022; b – Komán 2018; c – Komán and Lehoczki 2022)

The Russian olive timber's higher heating value by weight is not inferior to the characteristic value of the majority of hardwood species. It is practically identical to the values of black locust and green ash, and is somewhat higher than that of tree of heaven. The value of its higher heating value is practically identical to that of beech and English oak (Telmo and Lousada 2011). The energetical utilisation of its timber is well advisable, considering this property.

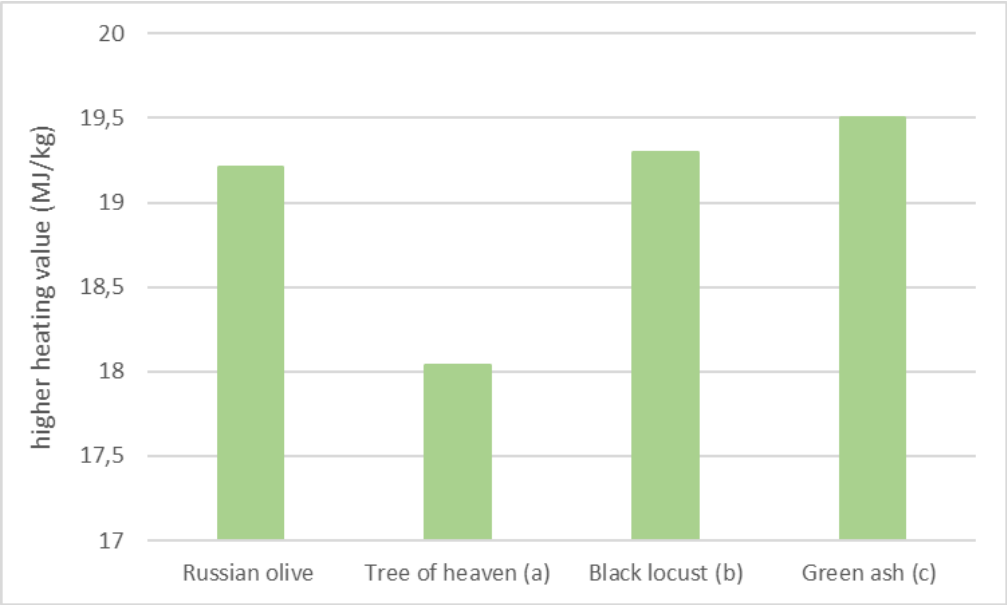

Figure 4: Higher heating value of Russian olive in comparison to other wood species (a – Kamperidou et al. 2018; b – Komán 2018; c – Komán and Lehoczki 2022)

CONCLUSIONS

The timber of Russian olive timber is of adequate quality for energetical utilisation in comparison to other invasive wood species, both in terms of ash content and higher heating value. As the volume of ash generated increases with the volume of wood burnt, its low ash content is a very favourable property. In the course of energetical utilisation, this has a positive affect on the operation of firing equipment and the deposition of the ash generated. The heat of combustion of its timber is equal to other hardwoods, therefore there is no reason not to exploit as an energy source.

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