Asian Journal of Plant Sciences 6 (3): 546-549, 2007
ISSN 1682-3974

The Effect of Stumping Back on Survival and Growth of Planted *Fraxinus angustifolia* Vahl

[1]Emrah Çiçek and [2]Fahrettin Tilki
[1]Faculty of Forestry, Duzce University, Duzce-81620, Turkey
[2]Faculty of Forestry, Kafkas University, Artvin-08000, Turkey

Abstract: Effects of stumping back on the performance of browsed or poorly developing *Fraxinus angustifolia* seedlings were investigated in the present study. One year old bareroot seedlings of *F. angustifolia* were planted at a spacing of 2×2 m in March, 2004. Most of the growing seedlings were damaged by heavy animal browsing or grew poor in the first growing season. At the end of the first vegetation period a randomized block design with three replications were designed to evaluate the effect of stumping back on the performance of *F. angustifolia* seedlings. The treatments were (A) undamaged seedlings with good growth (shoot increment >20 cm) not stumped back, (B) undamaged seedlings with poor growth (shoot increment <5 cm) stumped back and (C) damaged seedlings by heavy animal browsing stumped back at 8 cm above the root collar in December 2004. Singling was done in stumped back plants in mid-May 2005 and a healthy straight stem was left. It was found that stumping back significantly increased growth of poorly developing or heavy browsed seedlings and didn't reduce survival after two growing seasons following stumping back in December 2006.

Key words: Ash, nursery, plantation, seedling growth, stumping back

INTRODUCTION

Fraxinus angustifolia Vahl. (Narrow-leaved ash) is the most common and valuable native ash species and dominates the bottomlands forest of northern region of Turkey. It also grows in riparian areas and founds in mixed hardwood stands up to 700-800 m altitudes (Davis, 1987; Mayer and Aksoy, 1996). *Fraxinus angustifolia* stands have a high productivity on bottom land and mean annual increment can reach to 13 and 23 m^3 ha^{-1} in natural stands and plantations, respectively (Kapucu *et al*., 1999). It is a fast growing species with a rotation age of 40 years (Çiçek and Yilmaz, 2002). *Fraxinus angustifolia* is widely used in landscaping as well as in industrial plantations. It yields high quality wood and is especially preferred in the veneer, planking and furniture industry and its wood characteristics show similarities to *F. excelsior* (FRAXIGEN, 2005). Ash species is getting more important in forestry due to their fast growth ability and valuable woods and studies concentrate on their silviculture, breeding, genetics and gene conservation (Kerr, 1995; Pliura, 1999; Eriksson, 2001; Çiçek, 2002; Çiçek *et al*., 2006, 2007). Despite its relative importance, little is known about its plantation. Therefore, more information is needed for successful plantation establishment of *F. angustifolia*.

One important objective in forestry is to establish and maintain young trees with good height growth and health. Young planted stocks are most at risk from damage and adequate protection is an integral part of their establishment. Damage from extreme winter cold can occur to seedlings causing death of foliage and buds. Unseasonal frosts, whether in late spring or early autumn, can kill shoots and foliage and cause frost lift on heavy soils. Drought and damage from fire, diseases and pests can be a problem in young planted stocks. Beside these factors, young seedlings are frequently at risk from animal damage and browsing has been reported as a severe problem in artificial and natural regeneration of forests in many countries (Gill and Beardall, 2001; Sawadogo *et al*., 2002; Vila *et al*., 2001; Drexhage and Colin, 2003). Plants may undergo major morphological changes after browsing such as reduced heightand less side shoots combined with reduced foliage damaged, which can affect growth rate and may result in severe growth loss (Gill and Beardall, 2001).

If most of the newly planted seedlings are damaged by fire, browsing or frost in field, they should be removed and the site should be replanted again. Sometimes damaged species are subjected to stumping back. Stumping back is the practice of severely cutting back top growth to stimulate a vigorous initial shoot (Evans, 1984; Kerr and Evans, 1993; Kerr, 1995).

Achievement of good silvicultural techniques to maximize tree growth, survival and production of good form is a key element of successful plantation forestry. If the initial form or growth of trees is poor then stumping

Corresponding Author: Dr. Fahrettin Tilki, Faculty of Forestry, Kafkas University, 08000-Artvin, Turkey
Tel: 90-466-2126949 Fax: 90-466-2126951

back should be considered. In this research, the effects of stumping back on the performance of *F. angustifolia* seedlings showing forking or poor growing due to heavy animal browsing or planting shock were evaluated two growing seasons after stumping back.

MATERIALS AND METHODS

The research area was located on a bottomland artificial regeneration area in Adapazari, Turkey (40°48' N, 30°33' E, alt. 25 m a.s.l.). The site formerly supported a stand of *F. angustifolia* and there were also *Ulmus laevis*, *U. minor*, *Quercus robur*, *Q. hartwissiana* and *Acer campestre* as scatter trees. The soil on the study site has more than 70% clay and a pH of 7.5-7.9. The standing water level on the site may rise above the ground level through January-April; however summers may include drought periods. The study area experiences a warm, humid climate, with a mean annual temperature of 14.2°C, mean annual precipitation of 800 mm and the mean growing season precipitation of 560 mm. The growing season averages 230-240 days. Late summer to early fall is customarily the driest period of the year (Çiçek *et al*., 2006).

Older stands on the study site were clear felled and then the stumps were uprooted in fall of 2003. After the stumps and slashes were disposed, the soil was first ripped and then disk. One-year old bare-root seedlings (60-80 cm in height) were hand planted at a spacing of 2.0×2.0 m in March, 2004. Most of the growing seedlings were damaged by heavy animal browsing during the first growing season of 2004 and shoots of the seedlings were mostly damaged.

At the end of the first vegetation period a randomized block experiment were conducted with three replications in the study area. The treatments were (A) undamaged seedlings with good growth (shoot increment >20 cm) which were not stumped back, (B) undamaged seedlings with poor growth (shoot increment <5 cm) which were stumped back at 8 cm above the root collar and (C) damaged seedlings by heavy animal browsing which were stumped back at 8 cm above the root collar in December 2004. In each experimental plot, 30 seedlings per treatment were selected for measurement. Height and diameter were measured in treatment A and diameter was measured 2.5 cm above the ground level in treatment B and C after treatments. Singling was done in stumped back plants in mid-May 2005 and a healthy straight stem was left. For control of weeds removal of the vegetation around the seedlings was done by hand hoeing in June. Seedlings height and diameter were measured in three treatments two years after stumping back at the end of third vegetation period in December 2006.

Analyses of variance (ANOVA) were used to evaluate the stumping back effect. If analyses of variance indicated significant differences, Duncan's New Multiple Range Test was used to find the differences among means. The correlation coefficient was found between the seedling diameter of non stumped seedlings and height of stumped seedling two years after stumping back. Statistical analyses (ANOVA) were performed with the help of the computer software package SPSS.

RESULTS AND DISCUSSION

Seedling survival two years after stumping back did not show significant differences among treatments in the present study and field survival was 99% in all three treatments.

Seedling height, seedling diameter and diameter increment two growing seasons after stumping back did not also show significant differences among treatments. But stumping back increased height increment after two years and non-stumped seedlings had the lowest height increment (108 cm). Stumped seedlings in two treatments (B and C) were resprouting with good height growth with around 195 cm height increment (Table 1).

The correlation between the diameter of non-stumped seedlings and height of the stumped seedling two years after stumping back was high ($R^2 = 0.206$, $p<0.01$). This

Table 1: Effect of stumping back on early growth of *Fraxinus angustifolia* seedlings

	ANOVA sig.					
	1-year-old seedlings		3-year-old seedlings		Two-year increment after stumping back	
Treatments	Diameter (mm) p<0.05	Height (cm) p<0.001	Diameter (mm) p>0.05	Height (cm) p>0.05	Diameter increment (mm) p>0.05	Height increment (cm) p<0.01
A	10.5a[1]	93a	26.2a	201a	15.7a	108b
B	10.3a	8b	26.2a	204a	15.9a	196a
C	9.5b	8b	25.5a	205a	15.5a	198a

[1]Means within each column followed by the same letter(s) are not significantly different

means that increases in initial diameter of stumped seedlings increases height growth of stumped trees after two years following stumping back.

Stumping back is confined to tap rooted species and is the traditional method of improving poorly formed oak, such as results from repeated frosting and helping walnut above the worst of the frost. Its use is the best confined to ash, oak, sweet chestnut and walnut to increase height growth and improve the form of trees becoming bushy, or after fire damage in young seedlings (Evans, 1984; Kerr, 1995; Kerr and Boswell, 2001).

Kerr and Boswell (2001) stated that stumping back in young F. excelsior plantations after frost damage increased the seedling growth as found in the present study. Miegroet and Lust (1972) also found that ash was capable of responding well to release and to cutting back in regeneration area.

Seedlings of *Juglans nigra* that were cut back to 2.5 cm above ground at the time of planting grew twice as much in height as intact seedlings in all environments (Bey, 1974). Stumping was applied to one-year-old hybrid poplar (*P. nigra*×*P. trichocarpa*) plants and it was found that stumped plants had a much greater height increment in the third year (Bastien and Beaudoin, 1974).

Stumping back at the time of planting in *Juglans regia* did not reduce height growth after two growing seasons. However, the diameter of stumped plants at 50 cm from ground level was significantly less after two years and the plants were less sturdy. Stumping back did not promote significantly greater diameter growth at the root collar (Pope and Mayhead, 1994). Snellgrove and Mayhead (1995) found that survival was very good and not affected by stumping back in *J. regia*. Second-year height increments for stumped plants were greater than for control.

According to Evans (1984) stumping back confers no growth advantage and usually kill species such as beech and birch. Confine practice to larger seeded species with strong taproot, e.g., oak, chestnut, walnut and only if plants are less than 80 cm tall. But in the present study stumping back were applied to *F. angustifolia* seedlings taller than 80 cm and gave promising results.

Stumped seedlings can have a higher proportion of biomass in their root system and this can cause height increment in the stumped seedlings. In Turkey, since poor quality seedlings or small sized seedlings are planted in traditional *F. angustifolia* plantations and browsing in plantations are common, stumping back in the plantations can be used to increase form and height growth of seedlings and reduce re-planting cost.

It might be concluded that stumping back in artificial establishment of *F. angustifolia* may improve form of poorly developing or browsed/frosted damaged young plants and increase early height growth.

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