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ORIGINAL ARTICLE

## Relation of *Fraxinus excelsior* seedling morphology to growth and root proliferation during field establishment

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### Abstract

The demand for hardwood seedlings has increased in recent years in Italy, particularly for tree farming programmes oriented towards quality wood production; the availability of high-quality seedlings is a crucial step towards being successful in establishing such productive plantations. The aim of this work was to identify the most important morphological seedling quality attributes. Nursery stock consisting of 1-year-old bareroot *Fraxinus excelsior* seedlings was evaluated for field performance at the end of the first growing season on a plantation site in the Po Valley, northern Italy, in relation to the objective of producing high-quality timber plantations. The approach consisted of (1) morphological characterization (i.e. stem height, root collar diameter, shoot and root architecture) of the seedlings before outplanting; (2) morphological assessment (including root excavations) of the plants after the first year of field growth; (3) relating attributes observed during phases (1) and (2); and (4) identifying those morphological characteristics that effectively predict outplanting success. The results indicate that the highest quality seedlings are best selected on the basis of initial shoot height and root system morphological type (i.e. stem heights 40–50 cm with a fasciculate root system of at least 40 cm length and rich in fine roots). Planting these seedling morphological types may dramatically improve field performance (i.e. more than 100% increase of height increment in this case), which will help to promote the development of afforestation plantations oriented towards high-quality wood production.

**Keywords:** bareroot seedlings, field performance, forest nurseries, *Fraxinus excelsior*, reforestation.

### Introduction

In Italy, establishment of forest tree plantations for timber production has steadily increased during the past three decades (MAF, 1985; INFC, 2007a, b). European and national financing strategies have promoted the reduction of excess agricultural production and, concurrently, encouraged noble hardwood tree farming oriented towards high-quality timber production (Colletti, 2001). This has been one of the most successful programmes in terms of regional administration support and funding availability (Colletti, 2001; Camoriano, 2008). The approach of Italian foresters to establishment of these tree plantations has generally consisted of following traditional methods used during the

twentieth century, i.e. intensive reforestation activities for the restoration of degraded mountain areas using conifers. This tendency is apparent in the cultural techniques described in the first Italian handbooks on high-quality timber production plantations using noble hardwoods (Ciancio, 2000). Evaluation of these newly established plantations indicates that they have relatively low potential to be satisfactory for high-quality timber production (Tomat et al., 2005; Mori & Buresti, 2002; Cappelli et al., 2009). The causes of such failures are variable, but related to the general lack of silvicultural experience of technicians and plantation managers in Italy for the establishment of noble hardwood plantations with this specific aim and in such particular environments (Buresti & Mori, 2003).

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