Fraxinus Angustifolia for Planting in Sardinia (Italy) A Case Study of Innovative Agroforestry System

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***Abstract*—** *The case study reports about the development of a 18 years old* Fraxinus angustifolia *Vahl. tree plantation located in a representative test site for climate, soil and land use characters, of the agricultural planes of southern Sardinia, Italy. The favourable results about diameter at breast height (DBH) and other tree variables together with high potentiality for many ecosystem services too can identify this* Fraxinus angustifolia *tree plantation case study as an innovative agroforestry system.*

Keywords*— *Agroforestry, Fraxinus angustifolia, plantation, Sardinia.

I. INTRODUCTION

The Sardinia island (Italy) has traditional agroforestry systems but a high potential value for innovative systems too [1-2]. The agroforestry is integration of trees, crops and livestock on the same area of land and can be applied to all agricultural systems by planting trees on agricultural land or introducing agriculture in existing woodland [3-4]. The good practices in different situations assure many ecosystem services (soil protection, reduction of diffuse pollution, carbon sequestration, climate mitigation and to combat desertification, biodiversity and landscape conservation) too [5-6-7-8]. The case study reports about the development of an 18 years old *Fraxinus angustifolia* Vahl. [9] tree plantation located in a representative test site for climate, soil and land use characters, of the agricultural planes of southern Sardinia, Italy (Fig.1), looked as innovative agroforestry system.

II. MATERIAL AND METHOD

The case study concerns a plantation of *Fraxinus angustifolia* Vahl. established during the autumn of 1999 year at the Sanluri countryside (southern Sardinia, Italy), 50 km north of Cagliari (39° 31' N, 3° 36' E), partially covered by mediterranean vegetation dominated by *Cistus* spp., in the climate of western Mediterranean region (*semiarid type of tepido Mediterranean sub-climate*) with 610 mm of average annual rainfall, 15,6 C° of average annual temperature and summer drought period of 4 months (data collected from a nearby station in the decade of planting) [10-11-12]. After the harvesting of natural vegetation and an intensive preparation of soil (*typic xerocrepts*), deep over 80 cm [12], with fertilization too (kg ha^{-1} 100 P2O + 100 K2O) , the plants (2+0 bare rooted seedlings) were placed with spacing 3 x 3 m (between and within rows respectively) and density of 1111 p ha^{-1} above 6 hectares without irrigation. The observations on the survival and some phenotypic traits [13-14] of all living trees (Fig. 2-3) after 18 years (only a selective thinning occurred on 2013 year) were collected with a plot regarding over 1 hectare as total (transect of 90 x 117 m). The data have been interpreted by statistic analysis (ANOVA) and were compared with as much as reported on literature [15-16-17-18].

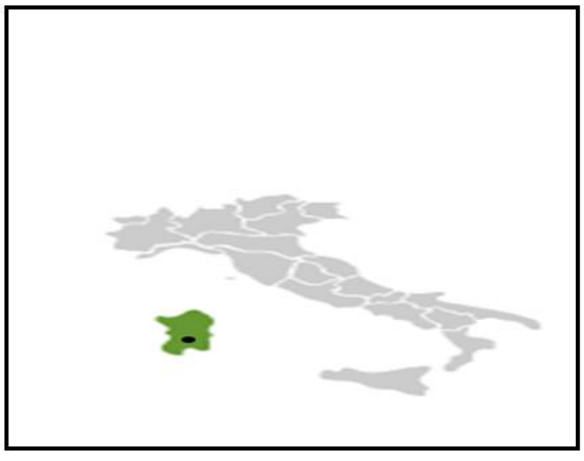

FIG.1 *Fraxinus angustifolia* tree plantation location (southern Sardinia, Italy)

FIG.2 *Fraxinus angustifolia* living trees in the plot on 2017 winter time

FIG.3 *Fraxinus angustifolia* living tree in the plot on 2017 winter time

III. RESULTS

The results, regarding the survival and some phenotypic traits of all living trees in the plot after 18 years are reported in the Figure 4, Figure 5 and in Table 1. The survival rate was almost 70 %, the average value of diameter at breast height (DBH) was 11, 9 cm, the average value of total height (H) was 8,7 m and the basal area (G ha^{-1}) was 8,35 m^2. The plot doesn't reflect significant differences regarding to each parameters.

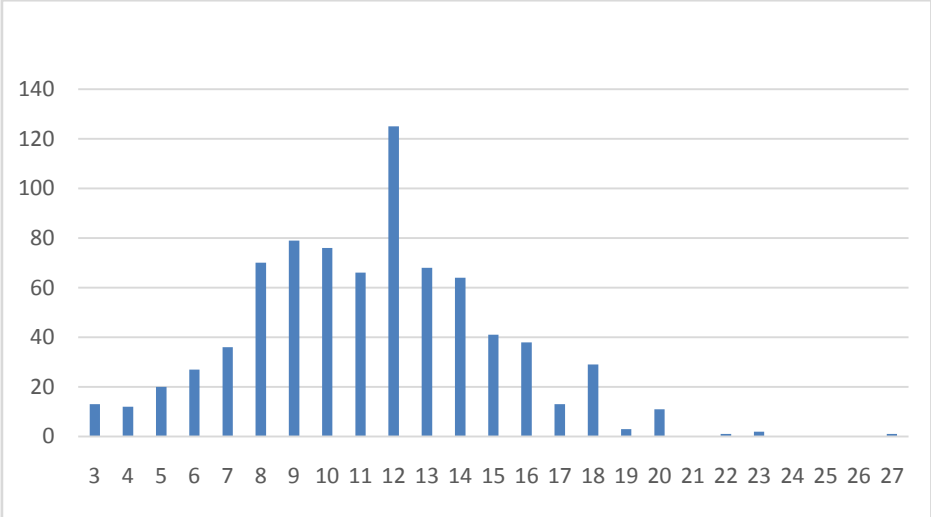

FIG. 4 Diameters (cm) distribution in the plot

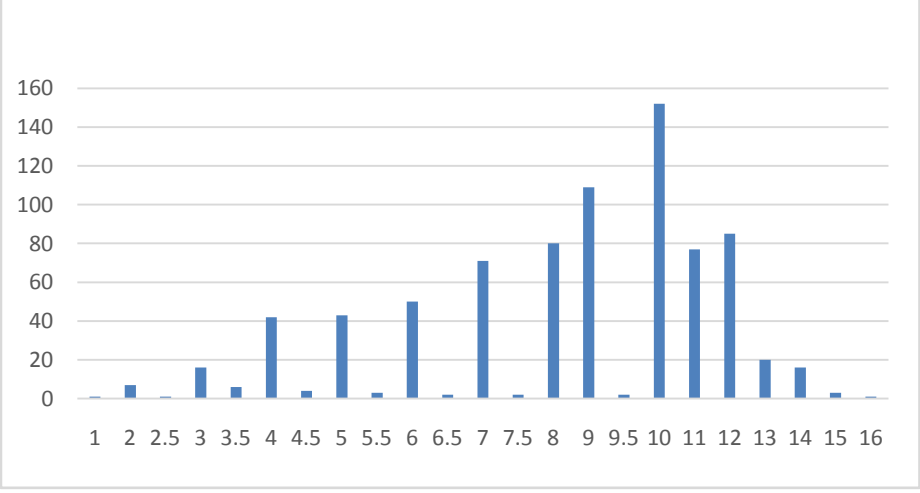

FIG. 5 Heights (m) distribution in the plot

TABLE 1
AVERAGE VALUES OF SURVEYED PARAMETERS

Average values of surveyed parameters			
Density (p ha^{-1})	DBH (cm)	H (m)	G ha^{-1} (m^2)
755	11,9	8,7	8,35

IV. DISCUSSION AND CONCLUSION

The development of a *Fraxinus angustifolia* tree plantation in a large and homogeneous agricultural area, representative as a test site for climate, soil and land use characters of the southern Sardinia (Italy) agricultural planes, after 18 years shows favourable results [15-16-17-18] about diameter at breast height (DBH), total height (H) and basal area (G ha^{-1}). The *Fraxinus angustifolia* tree plantation can be really an innovative agroforestry system in Sardinia (Italy). As matter of fact the role assigned to *Fraxinus* tree planting as in the case study at the same time appears to have high potentiality for many ecosystem services (soil protection, reduction of diffuse pollution, carbon sequestration, climate mitigation and to combat desertification, biodiversity and landscape conservation) too [5-6-7-8].

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