Journal of Forest Research: Open Access

OPEN ACCESS Freely available online

Research Article

Factors Hindering Seedling Survival in Sekota District, North Eastern Amhara, Ethiopia

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ABSTRACT

The study was conducted in Amhara regional state at Sekota district, North Eastern Amhara, Ethiopia. In three sites, to assess factors hindering seedling survival, the data were collected from 93 respondents at three Kebeles (Abya, Sayda, and Wolleh). According to the respondents; seedling grading, hardening off and seedling protection are applied at lightly level. Most of the respondents (90.3%) indicated that there was the problem of seedling survival after planting. Insect (termite) were the major biotic factors affecting seedling survival. Most of the respondents noted that the major abiotic factors affecting seedling survival were water stress and planting infertile soil. Drought and insect resistance species are ideal for the study area to boost up seedling survival. In addition, Way of nursery production methods and planting techniques must be adjusted as suitable for dryland areas. In planting sites, the appropriate water and soil harvesting structure should be constructed to improve water retention and soil fertility.

Keywords: Plantation; Drought; Biotic; Abiotic; Nursery

INTRODUCTION

Reforestation in the tropics takes place across a wide variety of edaphic and climatic conditions. Edaphic conditions have a strong effect on species growth and survival [1]. Plantations can play an important role in restoring the productivity, ecosystem stability, and biological diversity of degraded tropical lands [2]. While the number of trees planted can be an important factor in gauging the potential impact of these efforts (and is the primary metric tracked by each program), tree establishment in the landscape and longevity must ultimately be considered when assessing long-term program success [3]. Insufficient post-planting care, poor-quality nursery stock [4], limiting site conditions can all contribute to the death of transplanted trees before they are able to make meaningful environmental and economic contributions to a community [3].

According to the annual report of bureau of agriculture of the Amhara National Regional State (ANRS) 2012, 2013, 2014, 2015 and 2016, from all planted tree species seedlings survival rate were 75%, 64%, 66%, 79% and 81%, respectively. This indicates that there is an average of 73% survival rate within the past five years. It is estimated that a total of 362,564.24 hectares of land were covered by tree seedlings. In fact, the cover of the land is dominated by agricultural land and the forest cover is not as it is said and reported, due to failure of seedling survival rate.

In North Eastern Amhara region (Waghemira Zone), Governmental, non-governmental organizations and farmers have been planting many seedlings of different tree species year after year. However; the survivals of those seedlings are not as much of the regional average survival rate. With this background, the objective of this study was to assess biotic and a biotic factors that influence the survival of seedlings in Sekota districts.

MATERIALS AND METHODS

Study site description

The study was conducted at Sekota district (Woreda) which is about 450 km from Bahir Dar, the capital city of Amhara National Region State. It is located a total at 12° 23' to 13° 16'N longitude and 38° 44' to 39° 21' E latitude, with altitudinal rang of 1340 to 2200 above sea level (Figure 1). The mean annual temperature ranges from 16°C to 27°C. The rain fall pattern is unimodal with annual rainfall of 350 mm to 700 mm.

Data collection

Based on their agro-ecology three representative sites (Kebeles) namely: Abya, Sayda, and Wolleh were selected in Sekota district. The data were collected from primary and secondary source. For

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Received: September 29, 2020, **Accepted:** October 15, 2020, **Published:** October 22, 2020

Citation: Eshetie M, Kassaye M, Abebe G, Belete Y, Ngusie G, Asmare S (2020) Factors Hindering Seedling Survival in Sekota District, North Eastern Amhara, Ethiopia. Fores Res. 9:242. doi: 10. 35248/2168-9776.20.9.242

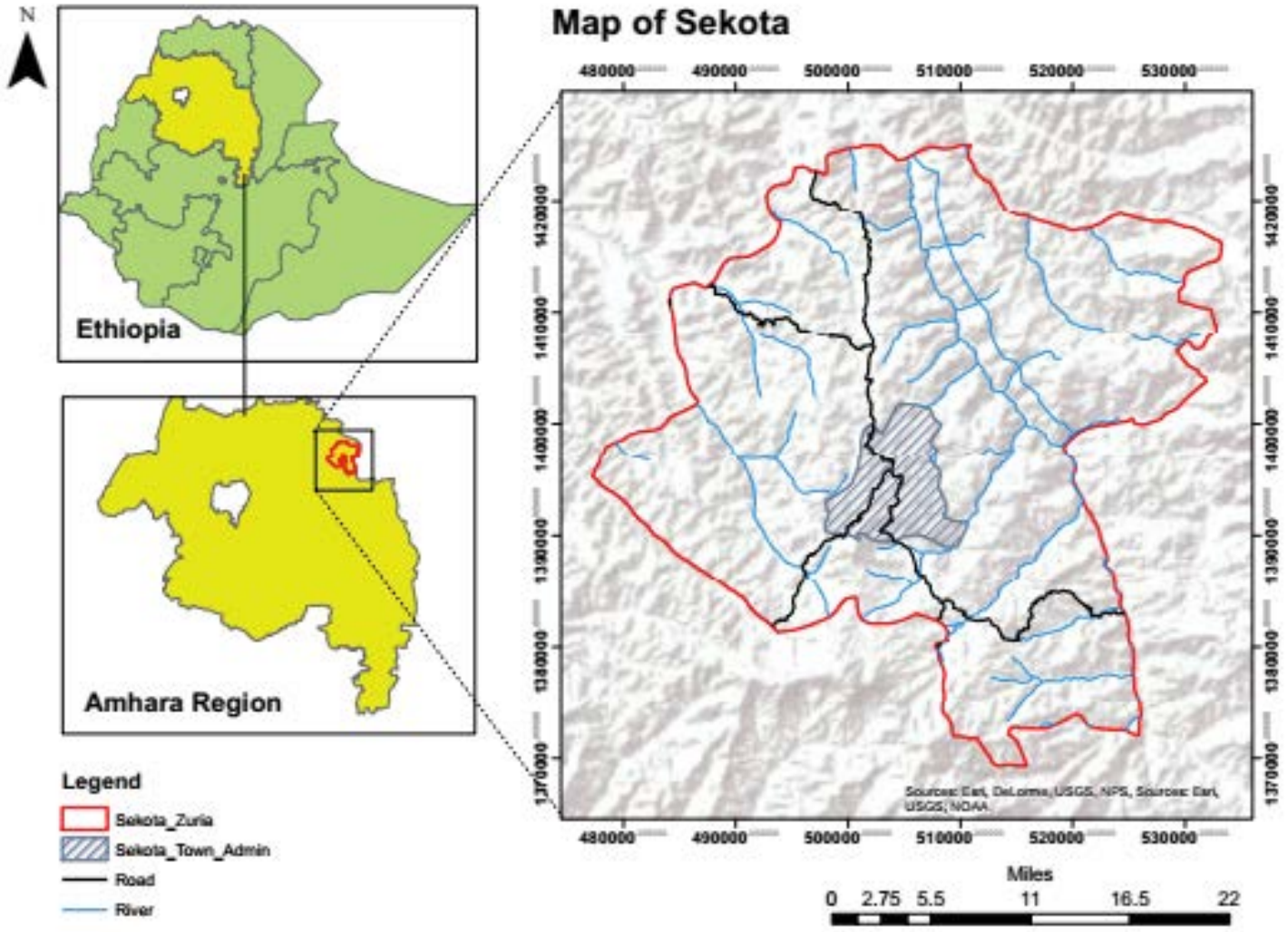

Figure 1: Map of study site.

primary data collection purposive sampling technique were used. Different tools such as household survey, semi structured, interview, group discussion and office visit were applied to collect the social data. Representative Key informants were selected in different age groups. The participants were diversified, including representatives of gender, marital status, social status and educational status.

Data analysis

Data were coded and entered in Statistical Package for Social Scientists (SPSS version 22). Descriptive statistics were used to describe the major factor that affects seedling survival.

RESULTS AND DISCUSSION

General household characteristics (information)

The total numbers of the respondents at three Kebeles were ninety three. Most of the respondents were ordinary residents and illiterate which hands-on crop and livestock production (Table 1).

Factors related with nursery activities

In the study area the seedlings were raised with 8 cm lay flat size of Polyethane tube and bare rooted. Due to this the performance of the seedlings was poor and incapable to survive for long dry season. Larger seedlings are generally considered to out-perform smaller seedlings after planting, due to greater nutrient and carbohydrate stores. Larger seedlings may establish better and suffer less mortality than smaller seedlings, particularly in stress-prone environments, e.g. those subject to drought or browsing damage [5]. Seedling size and climatic events may also influence the relative importance of different mortality agents [6]. Some respondents (29%) were raised bare root seedlings in private due to lack of Polyethane tube and give less attention for tree planting. Most of the respondents were applied lightly protecting, hardening and grading of the seedlings. Seedling survival and especially growth can be reduced by desiccation, low and high temperatures, and various forms of rough handling [4]. Commonly, the planting site was far away over 3.5kilometers from the nursery site. Most of the deterioration occurred in the first two days after lifting, while the plants were being handled and packed; drying during overnight storage and transportation to the sorting stand was reflected by poorer growth after each of these stages [4].

Activities related with planting and seedling observation on planting site

The majority of the respondents (90.77%) were contributed on planting site preparation. However, they were made commonly planting pit (66.67%) structure rather than soil and water harvesting structure. Some respondents were indicates that, the way of lifting the seedlings and planting to the site were through rolling by hand and picking the plant from the polythene tube (17.20%) and with

Table 1: General characteristics of respondents at Sekota District, Waghemira Zone.

Descriptions	Total No-	% No.
Sex		
Male	75	80.65
Female	18	19.35
Marital status		
Single	19	20.43
Married	65	69.89
Divorce	9	9.68
Social status		
Religious leader	6	6.45
Kebele administrator	6	6.45
Ordinary resident	81	87.10
Educational status		
Illiterate	52	55.91
Read and write	41	44.09

polythene tube (11.83%). The planting pit structure is incapable to hold sufficient water and fertile soil for seedlings. Due to this the seedling performance after planting was weak and unable to resistance for long dry season. In arid land systems, site preparation centers on improving moisture supply to the seedlings and reducing overall moisture loss by controlling competing vegetation [7]. Most of (67.8%) the respondents acknowledge that the seedlings were dead between July to January. It pointed that the seedlings are started to dead in planting season (July) because of planting with pit and inappropriate planting site and structure preparation.

Biotic and abiotic factors affecting seedling survival

Most of the respondent noted that the major biotic factors for seedling survival were insect (termite) (51.91%) and animal intervention (23.66%). Some respondents, 11.83%, 5.37% and 3.23% were indicated that plant disease and herbivores attack, weed suppression were another biotic factors for seedling survival, respectively. Similarly, Chisato [8] stated that termite mounds seem to be a negative factor for plants in that they cause trees to wither and suppress plants' growth. Cattle can negatively affect seedling growth rate and survival by trampling and browsing on seedling [9]. According to the respondents the major abiotic factors was water stress (95.70%) followed by planting infertile soil (78.49%) and lack of proper site cultivation after planting (58.06%) and using of damage seedlings (55.91%). Peter and Ronald [10] stated that severe water stress can injure tree seedlings and may kill them. McKay [4] also stated internal water status at planting, the condition of the nursery root system, the ability to control water loss through the stomata, the area of contact between the soil and functioning roots after planting, the soil moisture availability and the ability of the plant to produce new roots are all important. Similarly, the compaction of soil or low soil fertility results in high dry density which definitely reduced the rate of root penetration and development [11].

Activities applied for newly planted seedlings and sapling

Only 1.1% of the respondents were perceived that applied proper management (Watering, Weeding, mulching and protect from animal and human intervention) for newly planted seedlings, saplings and trees. However, suitable management and protection are crucial requirements for newly seedlings and saplings. Because, seedlings and saplings are sensitive to death in animal grazing and browsing, weed depression, herbivore, insects and other biotic and abiotic factors. Similarly, the most common cause of seedlings mortality, cattle, herbivore, canopy grass loading and insects [12].

CONCLUSION AND RECOMMENDATIONS

The main factors that hindering tree seedling survival were water stress and termite. However, nursery production methods, seedling handling and transportation, inappropriate site preparation, planting infertile soil and animal intervention were also pointed out by the farmers as main obstacles for tree and shrub plantation development. Therefore, Drought and insect resistance species are ideal for the study area to boost up seedling survival. In addition, Way of nursery production methods and planting techniques must be adjust as suitable for dryland areas. In planting site, the appropriate water and soil harvesting structure are must be constructed to encouraged water retention and soil fertility.

ACKNOWLEDGMENT

We would like to thanks Regional Forestry Research Directorate (FRD) to collaborate this activities. We would like to thanks Abya, Sayda, and Wolleh kebele development agents to facilitate data collection procedure. And also this study was conducted by the financial support of Amhara Region Agricultural Research Institute (ARARI)/Sekota Dryland Agricultural research Center.

FUNDING

The authors received no direct funding for this research.

COMPETING INTERESTS

The authors declare no competing interests.

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