

Factors Affecting Survival of Tree Seedlings in the Drylands of Northern Ethiopia

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Abstract

The major factors that affect the survival of tree seedlings in the drylands of Northern Ethiopia were studied using questionnaire which was administered to a total of 225 randomly selected farmers. Drought and moisture stress problem was perceived by 78.3% of the respondents; 58.6% of the respondents noted that low soil fertility as the main factor; 42.5% of the respondents acknowledge that termites are most importantly affecting the survival of tree seedlings. In addition, 25.2% of the respondents observed that livestock affected survival of tree seedlings mainly because of grazing and trampling. These results indicate that drought and moisture stress, low soil fertility, termites and grazing by livestock can significantly hinder the survival of tree seedlings on degraded lands of the study area. Therefore, proper allocation of species into the site is needed to address the problem and improve the forest development.

Keywords: Seedlings, growth, survival, moisture stress

1. INTRODUCTION

Establishing forest plantation on degraded lands can play a key role in harmonizing long-term forest ecosystem rehabilitation or restoration goals (Lamb, 1998). Forest plantations, using appropriate tree species can play an important role in the tropical ecosystem rehabilitation (Founoune et al., 2002). In such cases, planting of nursery-raised seedlings may accelerate regeneration (Yirdaw and Luukkanen, 2003).

Successful seedling establishment and growth depends on the soil condition and the stored soil moisture to ensure survival into the next growing season (Warren et al., 2005). Because, seedlings of some trees are sensitive to drought, and may be killed by even short dry spells (Engelbrecht et al., 2007). Weeds (Richardson, 1993); vertebrates (Porteous, 1993); invertebrates (Gadgil et al., 1995); seedling quality (Chavasse, 1980) are also commonly affects the growth, survival and distribution of tree seedlings.

In the dry and more degraded lands of Northern Ethiopia particularly Sekota District, farmers have been planting many seedlings of different tree species year after year but the survival of those seedlings are very poor as the area is mainly affected by moisture stress, termite and soil fertility problems. Again, the area has not been given much research attention and are still lacking. Therefore, the objective of this study was to assess the major factors that affect seedling survival in this particular area as it is critical to understand forest establishment and development.

2. METHODOLOGY

2.1 Study site

This study was conducted in Sekota District in Northern Ethiopia which lies between 12° 38' N lat, 39° 02' E long; elevation 2266 m above sea level. The mean annual rainfall and temperature of the area is 950 mm and 16.7°C respectively. Geographically, it has a very rugged topography of mountains, hills and gorges. The natural vegetation of the study area is mainly scattered bushes and shrubs and Acacia species. Calcaric Cambisol and Eutric Regosol are the most dominating soil types in the area (Abraham et al., 2013).

2.2 Sampling procedure and data collection

Based on the 2012 population census, there are 1500 farmers in the study area. From this list, semi-structured questionnaires were administered to 225 (15%) farmers randomly selected from the study area to solicit their perception on factors hindering seedling survival including which one they consider mostly existing in the area. Discussion with concerned development workers and local leaders was also conducted mainly focused on strengths, weakness, opportunities and threats to forest development and facts about the failure of forest development in the study area. Field observation was also carried out at different times of the investigation year to have an idea where and when are seedlings dying out.

2.3 Statistical analyses

Data from the questionnaire responses was coded and entered in Statistical Package for Social Scientists (SPSS version 16). Descriptive statistics was used to show the major factors that farmers considered as mostly dominant.

3. RESULTS AND DISCUSSION

The main focus of the investigation was to identify the major factors which influence the survival of tree

seedlings. Result of the survey indicated that 87.9 % of the respondents noted that environmental factors are the main problem in the study area while 12.1% of the respondents noted that biotic factors are the dominant.

Drought and moisture stress problems were perceived by 78.3% of the respondents in the study area. These are subjectively attributed by the farmers as there is continuous moisture stress from early September to end of June. Peter and Ronald (1996) also stated that severe water stress can injure tree seedlings and may kill them. However, the severity of water stress is unpredictable as it depends on many factors such as occurrence and distribution of rainfall, evaporative demands and moisture storing capacity of soils (Wery et al., 1994).

Most notably seedlings in drylands are highly limited by water availability and may have less survival in dry and moisture stressed areas where desiccation is high probable during the dry season. Similar results have been reported by Holl et al. (2000) that tree seedling death during drought can occur both as a direct result of water stress, or because drought can exacerbate the effects of non-drought factors such as pathogens, herbivores, competitors or light.

First-year seedlings are particularly vulnerable because they have neither the deep roots to tap a fast-receding water table nor the extensive root system to access a large soil volume. This chronic water shortage, along with other stressors like competition with herbaceous species, makes seedling establishment a limiting step in tree population dynamics (Lytle and Merritt, 2004).

In this particular investigation, 58.6% of the respondents noted that soil fertility problem as the main bottleneck for seedling survival. The study site has a very shallow soil and several inches below the soil surface is hard calcareous bedrock. May be due to this reason the vegetation cover is now sparse with heavily browsed trees and shrubs, stunted growth and poor vitality are becoming much more dominant. Berli (2004) and Casper and Jackson (1997) also stated that compaction of soil or low soil fertility results in high dry density which definitely reduced the rate of root penetration and development.

42.5% of the respondents also acknowledge that termites are most importantly affecting the survival of tree seedlings in the study area. Again, during the assessment period, a seedling survival problem due to the presence of termites was observed. Particularly, the harvester termites are predominantly found in the study area and these termites could be a major problem when growing tree seedlings. According to Chisato (2010), the rate of tree seedling withering in termite mounds was about three times higher than that of trees outside the mounds.

Another frequent source of disturbance for the survival of tree seedlings in the study area is cattle grazing inside the forest fragments. As the result of the survey have shown 25.2% of the respondents also observed that livestock affected survival of tree seedlings mainly because of grazing and trampling. Similarly, cattle grazing have been suggested by Lillian et al. (1992) as a principal cause for poor survival and recruitment in California's hardwood rangelands. Again, Harvey and Haber (1999) reported that cattle can negatively affect seedling growth rate and survival by trampling and browsing on seedlings.

4. CONCLUSION

The study focused on assessing factors affecting the survival of tree seedlings in the degraded drylands of Northern Ethiopia. Most of the problems or factors that are greatly affect the survival of tree seedlings are compounded by the environmental factors. However, the contribution of livestock grazing, and termite impacts were also pointed out by the farmers as main barriers for forest development in the study area. Therefore, proper allocation of species into the site is needed to address the problem and improve the forest development.

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