

Assessment of Factors Hindering Seedling Survival at Ankober Woreda, North Shewa Zone

Reta Eshetu*, Mesafint Minale, Abeje Tedila

Department of Agricultural Research, Addis Ababa University, Addis Ababa, Ethiopia

ABSTRACT

Tree planting in Ethiopia has been developed as a strategy to mitigate the negative effects of environmental change. However, this strategy has been challenged by failure or low survival of seedlings at field condition due to a number of factors. Hence, this study focused on assessing biotic, abiotic, and institutional factors that influence the survival of seedlings. The result revealed that 94.64 % of the respondents produced bare rooted seedlings; due to lack of plastic bag. According to respondents, factors that hinder seedling survival in the study area were: Insects (64%), frost (88%) and less attention given by government on pit digging and moisture retention preparation, seedling management and species selection without basic information. Therefore, special attention should be given on supplying, introducing and selecting tree species with basic information. Moreover, adequate management, proper follow up, monitoring and evaluation system must be designed to increase the survival rate of planted seedlings.

Keywords: Seedling; Survival rate; Biotic; Abiotic; Institutions

INTRODUCTION

The initial challenge of reforestation is accomplishing a successful seedling establishment. This is because, during the establishment stage, the seedlings are exposed to a lot of stress, both biotic and abiotic, that may cause seedling grow slowly, and in the worst case even severe damages and mortality [1]. This is especially serious when availability of water and nutrients are limiting factors.

Plantation forestry development using appropriate tree species and successful seedling establishment can play a vital role in ecosystem rehabilitation [2]. Although successful seedling establishment and growth depends on the soil condition and soil moisture of the planting site to ensure survival into the next growing season [3]. Because, seedlings of some trees are sensitive to drought, and may be killed by even short dry spells, weeds and seedling quality [4].

In the highlands of Northern Ethiopia, farmers have been planting many seedlings of different tree species year after year, but the survivals of those seedlings are very poor. According to the annual report of bureau of agriculture of the ANRS 2005, 2006, 2007, 2008 and 2009, 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. With this background the objective of this study was to assess the major factors that affect seedling survival in Ankober woreda as it is critical to understand forest establishment and development.

MATERIALS AND METHODS

Data collection

The study was conducted at Ankober wereda in Lay gorebela, Debdebo and Chefa Kebeles and the area located in 9°58'28"N latitude and 39°74'16"E longitude with an elevation range between 2400 m. a. s. l. to 3300 m. a. s. l. Initial survey was done where afforestation carried out from the highland agro ecology zone and one woreda was selected and further three Kebele were selected within the woreda. Purposive sampling technique was used to select the respondents. 5% sampling intensity in each

Correspondence to: Reta Eshetu, Department of Agricultural Research, Addis Ababa University, Addis Ababa, Ethiopia; E-mail: retaeshetu@yahoo.com

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sampling Kebele were carried out for interview. Structured and semi structured questionnaires were used for household survey; in addition, key informants and experts' group discussion were carried out.

Statistical analyses

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

RESULTS AND DISCUSSION

Household characteristics of the respondent

The basic characteristic of households of the study area was

Table 1: Household characteristics of the respondent at Ankober woreda North Shewa zone.

Household characteristics of the respondent	Lay gorebela	Debdebo	Chefa	Mean
Average age of respondents	42	38	42	40.7
Number of labor force per household	4	4	3	3.7
Number of dependent per household	2	2	1	1.7
Total family size of the household	7	6	5	6
Educational background of the respondent				
Illiterate	6	11	8	8.3
Read only	1	2	5	2.7
Read and write only	17	10	10	12.3
Primary education	9	12	12	11
Secondary education	5	2	2	3

Nursery management practices in the study area

95 % of the respondents had a private nursery site and raised bare rooted this is due to the lack of polythene tube availability and the direction given by the wereda office of agriculture to produce 300 seedlings per household. However, 5.36 % of the farmers got seedlings from neighbor farmers and government nurseries. Most of the respondents (70%) were watering

seedlings twice per day at the morning and evening time. Other nursery activities such as, shading, weeding and grading activities were done. But, hardening off and root pruning were not practices in the study area. Grass was the common material used for shading purposes (Table 2).

Table 2: Tree nursery production and management practices in the study area.

		Laygorebela		Debdebo		Chefa		Total	
		N	%	N	%	N	%	N	%
Seedling production method	Bare rooted	37	100	35	100	34	100	106	100

Watering frequency per day	Once	2	5.41	6	17.14	3	8.82	11	10.38
	Twice	30	81.08	15	42.86	30	88.24	75	70.75
	Three	4	10.81	4	11.43	1	2.94	9	8.49
Shading for seedlings	Yes	37	100	33	94.29	33	97.06	103	97.17
	No	0	0	2	5.71	1	2.94	3	2.83
Weeding management	Yes	37	100	35	100	28	82.35	100	94.34
	No	0	0	0	0	6	17.65	6	5.66

Major factors that hinder seedling survival rate at field condition

The main factors hindering seedling survival rate at field conditions mentioned by the respondents in the study area were abiotic, institutional and followed by biotic factors. As stated in the Table 3, the main biotic factors were insects (64%) and impact from animal (23%). This result was coincides with the work of Billy, et al., native tree seedlings planted on a degraded hillside grassland in Hong Kong, China. On the other hand, the

major abiotic was climatic factors (88%). Frost was the main climatic factor stated by farmers of the study area. Less attention given for tree seedling planting campaigns had also their own impact on seedling survival rate. Less support given for seedling producers, less attention was given on pit and moisture retention structure preparation, seedling management and species selection without basic information [5-7].

Table 3: Percent of biotic, abiotic and institutional factors that hindering seedling survival rate in the study area.

Variables	Number of respondents							
	Lay Gorebela		Debdebo		Chefa		Total	
	N	%	N	%	N	%	N	%
Biotic factors								
Human intervention	2	5.26	3	9.09	2	6.45	7	6.9
Animal intervention	14	36.84	8	24.24	1	3.23	23	23
Disease	2	5.26	1	3.03	2	6.45	5	4.9
Insects	20	52.63	20	60.61	26	83.87	66	64.7
Species type	0	0	1	3.03	0	0	1	1
Abiotic factors								
Frost	36	94.74	25	71.4	32	100	93	88
Edaphic	2	5.26	6	17.1	0	0	8	7.6
Topographic	0	0	4	11.4	0	0	4	3.8
Institutional factors								
Less responsibility of institution	38	100	5	16.1	4	11.1	47	44
Adoption species	37	97.37	4	12.9	2	5.56	43	41

without basic information								
Pit preparations and moisture retention structures	38	100	23	74	36	100	97	92
Less attention and management practice after planted	38	100	20	64	25	69.4	83	79

CONCLUSION

Most of the problems or factors that are greatly affect the survival rate of tree seedlings in the study area are compounded by methods of seedling production, biotic, abiotic and institutional factors. Insects, frost and lack of attention on pit preparation and moisture retention measures were also point out by the farmers as among those barriers of seedling survival at field condition. However, seedling transportation made by human being and traditional storage apparatus used also contribute its own. Hence, proper allocation of species in to the site, awareness creation for the farmers to develop a good attitude on nursery management and seedling production, supplying insecticide chemicals are need to address the problem and improve the forest development.

DECLARATION

Ethics approval and consent to participate not applicable

CONSENT FOR PUBLICATION

Not applicable

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AUTHOR CONTRIBUTIONS

The first author more contributed to this paper.

CONFLICTS OF INTEREST

There are not conflicts of interest between authors.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Permit: Permission to handle our study land was given by shewarobit town administration office.

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