

EFFECT OF IRRIGATION FREQUENCIES AND MULCHING ON THE ESTABLISHMENT OF VARIOUS TREE SPECIES IN CHITRAL-A CASE STUDY AT SYED ABAD

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Abstract

The study was conducted to assess the effects of various irrigation frequencies and mulching treatment on the survival of seven forest tree species namely: *Ailanthus altissima*, *Robinia pseudoacacia*, *Elaeagnus hortensis*, *Cedrus deodara*, *Pinus halepensis*, *Quercus baloot*, and *Eucalyptus camaldulensis*. Treatments of mulching, species and irrigation frequencies indicated significant differences on initial survival of seedlings. Plants showed better survival under mulching and irrigation thrice a month, while *E. camaldulensis* gave the best survival (11%) followed by *A. altissima* (6%) after 4¼ years of planting.

Introduction

Chitral district is situated in the extreme north west of Pakistan. It lies between 35° 12' to 36° 50' N latitude and 71° 2' to 73° 53' E longitude (Ayaz, S.M. 1964). The area of Chitral is very rugged and consists of deep valleys having steep and precipitous slopes, which are susceptible to erosion. The elevation of Chitral mountains ranges from 1084 m to 7579 m where the soils vary from shallow on slopes to stony in the plateau. It is a dry area where climate ranges in the valleys and lower slopes from dry subtropical through semi-arid with temperate to alpine at higher elevations. The area receives mean annual rainfall of 170 mm in the form of scanty showers and some snowfall at the end of October or early November. Frost is very common during winter, while the average monthly temperature ranges from 1°C to 36.7°C. The existing forests are distributed in the south with large areas of oak forests (*Quercus baloot*), while the forests on the dry soil consist of *Pistacia*, wild almond with *Pinus gerardiana*, while *deodar* and *juniper* are found at higher slopes.

The harsh climatic and soil conditions have restricted the natural regeneration of vegetation in the tract, while, the biotic factors have adversely affected the growth of vegetation. It is therefore imperative to identify suitable plant

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species and develop appropriate afforestation techniques for these areas, so that the land degradation process in this area is minimized. For such situations, Sheikh (1987) suggested to adopt proper water harvesting, economic use of water, moisture preservation by mulching, deep planting and species selection as planting techniques. This study was carried out to identify suitable tree species and study the efficacy of various irrigation frequencies and mulching technique for the initial establishment of forest tree species seedlings under very specific site conditions prevailing in Chitral area.

Materials and Methods

The study was carried out at Syedabad, located at 13 km from Chitral city towards Darosh and is almost a plain area. The experiment was laid out by using the Split-split plot design with the following treatments:

Major treatments:

- i. Stone mulch
- ii. Control (No mulch)

Intermediate treatments: Seven tree species, namely;

- i. *Elaeagnus hortensis* (Russian Olive)
- ii. *Robinia pseudoacacia* (Robinia)
- iii. *Ailanthus altissima* (Ailanthus)
- iv. *Quercus baloot* (Oak)
- v. *Pinus halepensis* (Quetta pine)
- vi. *Cedrus deodara* (Deodar)
- vii. *Eucalyptus camaldulensis* (Eucalyptus)

Minor treatments: Control and 3 irrigation frequencies viz;

- To = Control (No irrigation)
T1 = Irrigation* once a month
T2 = Irrigation twice a month
T3 = Irrigation thrice a month

(* One irrigation = 2 litres of water per plant)

The experimental area (approximately 1.0 ha.) was divided into 3 blocks (replications), plots and subplots (treatments) according to experimental design. Pits of 60 cm depth and 45 cm diameter at a spacing of 2 x 2m were dug for planting. Various treatments were allocated to plots and sub-plots through randomization.

One year old tube plants of *Pinus halepensis*, *Quercus baloot*, *Cedrus deodara*, *Eucalyptus camaldulensis* and bare rooted plants of *Ailanthus altissima*, *Robinia pseudoacacia* and *Elaeagnus hortensis* were planted according to the experimental design. Ten plants of each species in a sub-treatment of a replication were planted, thus a total of 1680 plants of 7 species were used in the whole experiment. In the mulching treatment, stone mulching around the plants in a radius of 25 cm was carried out after planting. To reduce the cost of manual irrigation, the irrigation treatments were limited to only first year of planting. The soil analysis of the trial site indicated that the soil is basic with pH from 7.9 - 8.4 and Ec of 0.25 to 0.50 dS m⁻¹. Soil is generally sandy loam having organic matter varying between 0.74 - 2.49%. The experimental area was completely fenced to avoid any damage to plants from animal grazing or human interference.

Results and Discussion

The survival data for different species were recorded on monthly basis. However, to assess the effects of various treatments i.e. mulching and irrigation frequencies on the survival of plants of different species in the early stage of the study, the data collected on seedlings survival after one year of planting in the month of November are given in the table below.

Table 1. Survival % of different species under various irrigation frequencies and mulching treatments at Syed Abad, Chitral after 1 year of planting

Species	Control (T0)		T1		T2		T3	
	Mulch	No mulch	Mulch	No Mulch	Mulch	No Mulch	Mulch	No Mulch
<i>Ailanthus altissima</i>	43	10	3	0	33	7	53	20
<i>Robinia pseudoacacia</i>	17	17	23	30	27	27	47	37
<i>Pinus halepensis</i>	13	3	43	27	63	57	40	33
<i>Quercus baloot</i>	17	7	57	10	7	3	77	47
<i>Elaeagnus hortensis</i>	0	13	20	13	7	0	13	3
<i>Cedrus deodara</i>	0	0	0	0	0	0	7	0
<i>Eucalyptus camaldulensis</i>	3	0	20	27	47	13	77	50

The above data were analyzed statistically and analysis of variance (Table 2) as well as L.s.d test were applied.

Table 2. Analysis of variance of survival data of seedlings of 7 species under various irrigation and mulching treatments

Source of variation	'F' Value
Replication	10.69 NS
Mulch	40.38*
Error(a)	
Major plots	
Species	7.16**
Mulch x Species	0.93 NS
Error(b)	
Sub plots	
Irrigation	9.21**
Irrigation x Mulching	0.44 NS
Irrigation x Species	3.36**
Irrigation x Species x Mulching	0.67 NS
Error(c)	

NS = Non significant at 5% level

* = Significant at 5% level of significance

** = Significant at 1% level of significance

The analysis of variance indicated that major treatment (mulching) was significant at 5% level. Intermediate treatments i.e. 7 species and minor treatments i.e. irrigation frequencies were significant at 1% level. Interaction between irrigation and species were also significant at 1% level. L.s.d. test indicated that mulched plants had better survival than un-mulched and were significantly better at 5% level. Use of various types of mulch material to conserve moisture to the benefit of the plant has been in vogue since long in many countries. Sheikh (1986) and Hussain & Sheikh (1986) in various dry afforestation studies, found stone mulching around seedlings of various forest tree species significantly beneficial to the growth of various forest tree species and recommended use of mulches wherever available. In four other mulching studies on establishment of Juniper seedlings at Ziarat (Balochistan) Sheikh (1985) concluded that stone mulching although expensive is the best treatment. The present study revealed that irrigation treatment (three times a month) is significantly better than the rest of the irrigation treatments. Deodar showed very poor survival as compared to other species.

After one year of planting the irrigation treatments were terminated and the plants were left to survive under natural rainfall conditions. After four and quarter years of planting the survival data of plants were recorded to assess the survival

performance of plants of various species under various treatments and are given in the following table.

Table 3. Survival (%) of different species under various irrigation and mulching treatments after 4¼ years of planting at Syedabad, Chitral

Species	Control (T0)		T1		T2		T3		Mean species survival (%)
	Mulch	No Mulch	Mulch	No Mulch	Mulch	No Mulch	Mulch	No Mulch	
<i>Ailanthus altissima</i>	13	7	0	0	20	0	7	0	6
<i>Robinia pseudoacacia</i>	0	0	0	0	0	0	7	0	1
<i>Pinus halepensis</i>	13	0	3	3	0	7	0	0	2
<i>Quercus baloot</i>	0	0	7	3	0	0	20	13	4
<i>Elaeagnus hortensis</i>	0	13	7	0	0	0	0	0	3
<i>Cedrus deodara</i>	0	0	0	0	0	0	0	0	0
<i>Eucalyptus camaldulensis</i>	0	0	3	10	17	0	30	27	11

The survival percentage of all the species were reduced to a great extent during the years and ranged from 0-11%. *Eucalyptus camaldulensis* showed the highest survival rate (11%) followed by *Ailanthus* (6%) after 4¼ years of planting. *Eucalyptus camaldulensis* and *Ailanthus altissima* have good adaptability under temperate and sub-tropical climates, low rainfall, frost and chilling winters and a wide variety of soils (Anon. 1980), the same behaviour has been shown by these two species under this trial and indicated their suitability for this area. These species seem to have good prospects for afforestation in this area as both of these species have the qualities required under the site conditions of the experimental area.

Survival of seedlings indicated a positive response to mulching where the survival of all the mulched plants of seven species was almost double (%%) of the un-mulched plants (2.6%) after 4¼ years of planting. Generally the plants exhibited positive response to irrigation treatments in which the survival increased considerably with increasing the frequency of irrigations per month. Plants under highest frequency of irrigations (thrice a month) showed significantly better survival than those with no irrigation. Control (T0) and T1 treatments showed the same response.

Conclusion and recommendation

The local site conditions are extremely unfavourable for plant growth, specially the drought conditions and hot winds in summer season. However, on the

basis of survival data of various species in the experiment, *Eucalyptus camaldulensis* and *Ailanthus altissima* seem more suitable to the local site conditions as compared to other species tested. Stone mulching as well as higher frequency of irrigation proved effective in initial survival of different species. Irrigation for only first year of planting did not give satisfactory survival of plants, therefore, in addition to stone mulching at least three irrigations in a month for the initial 2-3 years after planting are recommended to achieve better survival of plants in sites similar to Syedabad.

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