The Pakistan Journal of Forestry Vol.51(1), 2001

EFFECT OF WATER CONSERVATION TECHNIQUES ON THE ESTABLISHMENT AND GROWTH OF FOREST TREE SPECIES IN SCRUB ZONE

Raza-ul-Haq[1] and Abdul Kaliq Chaudhry[2]

Abstract

Water conservation techniques viz. contour trenches, Gradoni and V-shaped micro-catchments were compared with conventional method of planting on four species viz. *Eucalyptus camaldulensis, Leucaena leucocephala, Acacia nilotica* and *Acacia modesta* at Kharian. Data on survival and growth of these species were recorded.

The survival under different water conservation techniques i.e contour trenches, micro-catchment and Gradoni was 79%, 78% and 82% respectively while in simple pits it was only 70%. The average highest survival percentage of three water conservation techniques was in *E.camaldulensis* (92%) and minimum with *Acacia modesta* (57%).

The average height growth after 8 years of age of four tree species in contour trenches, micro-catchment, gradoni and simple pit was 4.74 m, 5.45 m, 5.30 m and 3.89 m respectively. Maximum positive response to the conservation techniques was observed with *E.camaldulensis* which gained almost two times more height (8.28 m) in 3 conservation techniques as compared to simple pit (4.63 m).

Introduction

This study was conducted at Pabbi forest, Kharian to evaluate the efficacy of water conservation techniques for enhancing the productivity of forest tree species in scrub zone of Pakistan. The area lies near 73.8° East longitude and 33.0° North latitude. Mean annual rainfall of the area is about 800 mm, out of which 70% is received during monsoon. The soil of study site is sandy loam. Natural vegetation includes *Acacia modesta* and *Olea ferruginea* as major tree species. Both these species are slow growing but the area has potential for afforestation with fast growing tree species such as *E. camaldulensis, A. nilotica, A. elata, A. saligna, A. albida* and *Leucaena leucocephala* (Anon, 1994, Shah, 1990 & Sheikh, 1986).

1 Central Silviculturist, Pakistan Forest Institute, Peshawar
2 Assistant Silviculturist, Pakistan Forest Institute, Peshawar

Scanned with CamScanner

Materials and Methods

An experiment was laid out at Pabbi forest Kharian in split plot design having four replications to evaluate different water conservation technique for the establishment of fast growing tree species in scrub zone of Pakistan. The tree species as major while water conservation techniques were minor treatments.

Contour trenches. Gradoni and V-shaped micro catchment were tested to compare with simple pits for the establishment of tree species like *E. camaldulensis*, *Leucaena leucocephala*, *A. nilotica* and *A. modesta*. The experiment was replicated three times with 20 plants per plot.

Contour trenches (4 m x .4 m x .5 m) were excavated along the contour having pits of 0.6 m diameter and .6 m depth at both ends. The depth at the centre of the trench was kept only 0.15 m deep sloping towards both the pits at the ends. The soil so obtained was piled on down hill side and extended upward and outward in a cresentic shape. The contour trenches were staggered in the rows. Planting was done in the pits.

One meter wide hill side ditches (gradoni) were excavated along the contour with level bench having 0.3 m high berm on the down hill side. Plant pits of 0.6 m diameter and 0.3 m depth were excavated at 4 m spacing in the centre of gradoni. Distance between successive gradoni was 4 meters.

V-shaped microcatchments on the hillside were constructed. On the V-natch a pit of 0.8 m diameter at surface and 0.5 m diameter at the base and 0.5 m deep was dug. The excavated soil was piled on the down hillside and extended upward and outward as berms making an angle of 90° with each other upto 1.0 meter. A very shallow and narrow trench line (0.1 m x 0.1 m) was extended farther upward and outward upto 1.8 m from the lower end of the pit. The spacing of the pit was 4 x 4 meters. The microcatchments were staggered in rows

The conventional simple plant pits having 0.3 m diameter and 0.3 m depth were made for planting as control for comparison with the water conservation techniques.

Earth work for water conservation treatments was done in October/November 1988 while planting was done in January, 1989 with hand-watering. Restocking were completed in monsoon of 1989. The survival and height growth of plants recorded during 1998 is presented in this paper.

Results and Discussion

The results showed that all water conservation techniques were quite

Scanned with CamScanner

successful as compared to planting in simple pits (control) for the establishment of forest tree species (Table-1).

Table 1. Survival percentage of four tree species with and without water conservation techniques at Kharian.

Water conservation techniques	*E.camaldulensis*	*L.leucocephala*	*A. nilotica*	*A. modesta*	Av. Survival %age
Contour trenches	92	93	73	58	79
Micro catchment	93	85	82	52	78
Gradoni	90	90	87	62	82
Av. Survival %age o WCT	92	90	80	57	80
Simple pit (control)	72	77	80	53	70

WCT = Water conservation techniques

The average survival percentage of seedlings under contour trenches, micro-catchments and gradoni was 79, 78 and 82% respectively, while in simple pits (control) it was 70%. The survival percentage with water conservation techniques among the tree species, *E.camaldulensis*, *L.eucocephala*, *A. nilotica* and *A. modesta* was 92, 90, 80 and 57%, while it was 72, 77, 80 and 53% with simple pits respectively. In a species trial under barani conditions at Kharian, Hussain and Sheikh (1986) found that *A .modesta*, *L. leucocephala* and *E. camaldulensis* gave survival percent of 68, 68 and 66% respectively. The response of *E. camaldulensis*, *L. leucocephala* and *A. nilotica* in this study was higher with water conservation techniques than in simple pits (control).

The average height growth after 8 years of age for different tree species planted with water conservation techniques and conventional plant pits are given in Table 2.

The average height growth of tree species planted in contour trenches, micro catchments, gradoni and simple pits was 4.74 m 5.45 m, 5.30 m and 3.89 m respectively. The height growth of seedlings with water conservation techniques was comparatively higher (by about 32.6%) than simple pits. Maximum positive response to the water conservation techniques was observed in *E.camaldulensis* which attained two times more height when planted with water conservation techniques (8.28 m) as compared to simple pits (4.63 m).

Scanned with CamScanner

The average height growth of *L. leucocephala* and *A. nilotica* with water conservation techniques was 6.49 m and 4.27 m and in simple pits it was 6.00 and 3.33 respectively, while the average height growth of *A. modesta* seedlings with and without water conservation techniques was the same (1.61 m).

Table 2. Average height growth (m) of tree species planted with and without water conservation techniques at Kharian.

Water conservation techniques	*E.camaldulensis*	*L.leucocephala*	*A.nilotica*	*A.modesta*	Av. Height (m)
Contour trenches	8.29	5.55	3.58	1.54	4.74
Micro catchment	8.02	7.09	4.99	1.6	5.45
Gradoni	8.52	6.84	4.23	1.60	5.30
Av. height (m) WCT	8.28	6.49	4.27	1.61	5.16
Simple pit	4.63	6.00	3.33	1.61	3.89

WCT = Water conservation techniques

The analysis of variance (ANOVA) was carried out both for species and treatments. The analysis results are tabulated as under.

Sources	D.F.	S.S	M.S	F.Ratio
Treatment	4	6.17	1.542	2.355^{ns}
Species	3	104.29	34.763	53.073^{*}
Error	12	7.86	0.655	
Total	19	118.32		

ns Non-significant as 1% level of probability
* Significant at 1% level of probability

As per ANOVA, there is no significant effect of treatments. All water conservation techniques (i.e. Contour trenches, microcatchment, Gradoni and simple pit) have same effect but the first three treatments are comparatively better than the simple pit. However, there are significant differences between species in height growth.

Sheikh (1984) recommended planting of many *Acacia* species in the arid areas with mean annual rainfall of 200 mm by using trenches with sloping catchments.

Scanned with CamScanner

The results have shown that water conservation techniques have same effect but superior to simple pit for the initial establishment of plants in the scrub zone. The techniques are also useful for enhancing the height growth of some of the fast growing tree species like Eucalyptus.

Acknowledgement

The authors are thankful to the field staff at Kharian for the help in data collection and maintenance of the experiment.

References

ANNON 1994. Annual Progress Report, PFI, Peshawar.

Hussain, R.W. and M.I. Sheikh. 1986. To develop techniques for utilizing arid and semi arid lands through planting under dry conditions. Final Technical Report, 1986. Pakistan Forest Institute, Peshawar.

Shah, B.H. 1990. Efficacy of Water Conservation Techniques for afforestation of watershed in scrub zone. PJF 40(4): 278-286.

Sheikh, M.I. 1984. Technical Notes (Nos. 1-55). Pakistan Forest Institute, Peshawar

Sheikh, M.I. 1986. Afforestation of arid and semi-arid areas of Pakistan FAO/PFI, Peshawar.

Scanned with CamScanner