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SHADE REQUIREMENT OF *ACACIA NILOTICA* AT NURSERY STAGE.

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In this study effect of Green sheet shade and no shade were studied at nursery level on *Acacia nilotica* tree species to determine the effect of partial shade on seed germination, survival and growth performance of seedlings. The results indicated that this species is not shade tolerant at nursery stage.
Key words: Shade effect, tree growth, nursery, partial shade.

INTRODUCTION

Green sheet nursery sheds are gaining popularity in all kinds of nurseries in the Punjab. This sheet blocks about 70% of sunlight from reaching the plants. Shade loving plants remain happy under the green shed while it hampers the growth of light demanding plants. This shed was erected at research nursery, Punjab Forestry Research Institute during 2003 and different forest trees are being grown underneath it.

The production of high quality planting stock is of prime importance for the establishment of plantations in public or private sector. A quality seedling must have maximum survival potential during nursery, lifting, transportation, planting and post-planting environmental stress such as desiccation and high temperature. Given the prevalent semi-arid to arid environmental conditions, some shading is probably essential, particularly during the initial stage of seedling development.

Shading definitely affects the morphological and physiological performance of developing plants. Shade increases shoot growth at the expense of root growth, hence decreasing the extent of absorption surface relative to transpiration surface i.e. root/shoot ratio (Kramer and Kozlowski, 1979). The natural overhead shading increases the relative proportion of red light reaching the plants, causing stem elongation, an effort by the plant to reach the upper canopy for normal light (Salisbury and Ross, 1978). The leaves of plants grown under normal sunlight are smaller and possess a greater volume and more chlorophyll contents per unit area of leaf than leaves of plants grown under the shade (Kramer and Kozlowski, 1979).

There are a smaller number of stomata and lower mesophyll resistance to CO_2 diffusion in leaves of plants grown under the sun (Boardman, 1977). Shaded plant leaves also might have fewer carbohydrates reserves which could be used to fuel root generation immediately after out planting when the seedling's photosynthetic mechanism is less active due to the shortage of water. The overall effect of heavy shading is to reduce seedlings ability to withstand high temperature and water stress thereby decreasing survival rate. The question therefore arises: What level of nursery shading is necessary to keep the seedlings healthy so that quality seedling heaving maximum survival potential are produced? The present study was carried out with this question in view to adjudge the green sheet shade effect on seedling growth of *A. nilotica*.

MATERIAL AND METHODS

This study was conducted at research nursery, Punjab Forestry Research Institute, Faisalabad; from February to May 2004. Using paired plot design with thirty replications and two plants per replication. Two treatments were tested between them, one was shade and other was no shade treatment. The shading level was established by placing p.bags under the green sheet shed. Seedlings of *Acacia nilotica* were raised in polythene tubes of size 2cm x 15cm, with 40 perforations and filled with thoroughly mixed medium of 33% sand and 66% soil. The seeds were water soaked for 24 hours prior to sowing. Seeds were sown directly in polythene tubes at the rate of 2 seeds per tube. There were 1330 number of tubes placed in direct sunlight and 560 tubes under green sheet shed. All tubes were watered as per requirement of the plants. After germination 30 plants were selected from each treatment for diameter at root collar (DRC) and height growth measurements. These were arranged in an array of 5 x 6 = 30 tubes in both treatments. Growth data of plants i.e. DRC and height was collected at the age of 6 and 12 weeks. Five plants were taken randomly from each treatment for fresh & dry weight and root shoot ratio measurements after 6 and 12 weeks.

Statistical analysis of the data was done by using T-test where the observations are paired. The formula used was:

$$t = \frac{(d-0)}{sd\sqrt{n}}$$

$$t = \frac{(d-0)\sqrt{n}}{sd}$$

Where $d = n_1 - n_2$ and
sd = variance of difference
n = number of observations

RESULTS AND DISCUSSION

Germination

Germination data revealed that germination in direct sunlight (84.6%) was significantly different from germination under green sheet cover/partial shade (33%). From the Table 1, it is clear that germination under shade conditions took about double time as compared to no shade. This indicates that germination of *Acacia nilotica* seeds is negatively correlated with the shade.

Table 1. Germination percentage and Time period in *Acacia nilotica* under shade and no shade treatment

Treatments		
Parameters	Partial shade	No. Shade
No. of seed sown	560	1330
No. of seeds germinated	185	1125
Germination %age	33	84.6
Germination Time period (days)	34	19

Survival

Survival data showed that there was no significant difference in survival under both the treatments for first 6 weeks (Table 2). However, after 12 weeks survival %age decreased under shade conditions from 100% to 82% while it was 97% under no shade treatment. This indicates that under shade conditions plants were weak and could not withstand prolonged shade conditions.

compared to shade treatment. *Acacia nilotica* gained significantly better height and DRC under no shade conditions. It was observed that shade inversely affect growth of the plants under shade conditions. Champion and Trevor (1987) was of the view that shade bearers are those plants, which are capable of regeneration and development under more or less complete canopy of other species, while light demander acquired more light for regeneration and development. According to Singh (1982) *A. nilotica* is a strong light demander. Similarly Troup (1921) reported that *Acacia nilotica* grows best in full sunlight. Chaudhry (2001) reported that *Acacia nilotica, Prosopis cineraria, Leucena leucocephala and Eucalyptus camaldulensis* are light demander and need no shade at nursery stage, however, light shade may be given at early stage of seedlings development to enhance survival percentage.

Green and Dry weights

Under the effect of shade and no shade conditions green and dry weights of seedlings after 6 & 12 weeks differed significantly from each other (Table 2). Significantly better green and dry weights under no shade treatment are indicative of the fact that seedlings growth was poor under shade treatment and seedlings were physically weak and thin as is clear from the green and dry weights. The seedlings did not put proper diameter at root collar and gain in height under shade conditions. This indicates that seedlings of *Acacia nilotica* tree species are not shade tolerant. Groninger et al. (1996) observed that shade decreased

Table 2. Mean Survival, height, diameter at root collar, fresh & dry weights and root shoot ratio of *Acacia nilotica* under shade and no shade treatments recorded at the age of 6 & 12 weeks.

Parameters	Treatments			
	Partial shade		No shade	
	6	12	6	12
Survival %age	100a*	82b	97a	97a
Height (cm)	17.27b	40.89b	20.07a	46.99a
Diameter at root collar (cm)	0.16b	0.22b	0.24a	0.36a
Fresh weight (gms)	0.58b	2.08b	1.34a	6.00a
Dry weight (gms)	0.17b	0.80b	0.58a	2.80a
Root length (cm)	10.21a	37.69a	16.87a	42.01a
Root/shoot ratio	1:1.47	1:0.97	1:1.19	1:1.3

* Mean values having similar letters are non-significant from each other.

Growth

Growth of seedlings concerning height and collar diameter was measured after 6 and 12 weeks of the start of study (Table 2). Statistical analysis of data showed that growth of the plants (height and DRC) was highly significant under no shade treatment

total biomass for tree species. According to Jisheng (1986) 90% of the tree biomass comes from photosynthesis products. The yield and biomass production of the plants correlates positively with the net photosynthetic capacity. It appears that the species having higher contents of chlorophyll has a higher rate

of photosynthesis and growth, indicating that a direct relationship exists between chlorophyll content, photosynthesis and growth. The total dry weight yield of a field crop is the product of the length of the growing season and the crop growth rate. Solar energy, if not limited by other factors such as water and nutrients availability, controls dry matter production by crops (Driscoll, 1990). According to Kramer and Kozlowski (1979), among the factors, genetic control of anatomical changes in leaves, changes in chlorophyll, respiration rates, photosynthesis and various metabolic changes in competitive situations are important.

Root/Shoot Ratio

Root length was measured at the time of green weights calculation. It has been observed that under shade conditions shoot growth was more than root growth at the age of 6 and 12 weeks while under no shade treatment the difference in root and shoot growth was less (Table 2). At the age of 12 weeks shoot growth reduced compared to root growth under shade treatment. However, shoot growth was slightly more under no shade treatment compared to root growth. Statistical analysis of root growth data showed that both the treatments were not significantly different from each other. Root-shoot ratios in Table 2 depict that there was more fluctuation in root-shoot ratio under shade conditions compared to no shade treatments at 6 and 12 weeks of age.

CONCLUSIONS

Acacia nilotica tree species is light demander and need no shade at nursery stage. However light shade may be given at early stage of seedling development to enhance survival %age. At the time of germination it requires full sunlight. The seedlings under shade were physically much weaker than that in open.

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