Academic Journal of Plant Sciences 3 (1): 33-36, 2010
ISSN 1995-8986

Evaluating the Growth Performance of *Cassia nodosa* and *Cassia fistula* L. Seedlings Using Different Potting Mixtures

H.S. Al-Menaie, O. Al-Ragom, A. Al-Shatti, M. Mathew and N. Suresh

Arid Land Agriculture and Department of Greenery, Kuwait Institute for Scientific Research,
P.O. Box: 24885, Safat 13109, Kuwait

Abstract: Among the various factors affecting seedling growth, composition of the growing medium is the most important. To investigate the effect of different soil mixtures on the growth of Pink shower (*Cassia nodosa*) and Golden shower (*Cassia fistula*) seedlings, an experiment was conducted using agricultural sand: peat moss: potting soil (humus) at ratios of 1:1:1, 2:1:1 and 3:1:1 (T1, T2 and T3, respectively) under controlled conditions inside the greenhouse at Kuwait Institute for Scientific Research (KISR). Data on vegetative parameters namely plant height and number of leaves were recorded for a period of eight months from planting and the effect of soil mixtures on the rate of growth of the two *Cassia* species were analyzed using R procedure for analysis of variance. The effect of soil mixture on the growth of *Cassia* seedlings was found to be significant. Both the species of *Cassia* showed better growth and development in the soil mixture containing sand: peat moss: potting soil in equal proportions (1:1:1) compared to other soil mixtures and this could be used as a standard potting medium to maintain satisfactory plant growth and development.

Key words: *Cassia nodosa* · *Cassia fistula* · Soil mixtures · Potting medium

INTRODUCTION

Cassias are ornamental flowering trees of great beauty, which belongs to the family Fabaceae. Pink shower (*Cassia nodosa)* and or Golden shower (*Cassia fistula)* are renowned for its ability to adapt to hostile environments and their efficacy with regard to the recreational value in gardening, landscaping and bioaesthetic scheduling is very high. Since Kuwait is characterized by unfavorable soil and climatic conditions, ornamental plant section is limited [1] and care has to be taken to select trees with good vigor, color and an abundance of blooms. A previous study conducted by Bhat and Al-Menaie [2] showed that seedlings of *Cassia fistula* survived under the climatic conditions of Kuwait but did not include a detailed study on seed germination and plant growth requirements. Hence, this study was initiated to screen, evaluate and introduce *Cassia nodosa* and *Cassia fistula* trees to the landscape architecture of Kuwait to break the monotony of greenery plants [3].

Plant growth requirements are key components that determine the growth and survival of introduced trees. In arid regions, among the plant growth requirements, soil is the most important factor that acts as a reservoir for nutrients and moisture, provides physical weight of a tree and resists the forces of wind. Nutrient availability and soil texture determine biomass allocation, seedling growth and survival [4, 5]. Composition of growing medium among many other factors affects the growth of trees in the greenhouse [6, 7]. A study conducted on *Gardenia jasminoides* also showed that growing media has a significant role in the physiological growth parameters like leaf area, chlorophyll index and canopy spread and thereby maximize flower production [8]. Growing media are materials, other than soils *insitu,* in which plants are grown [9]. Good growing medium holds water and nutrients, provides pore space for oxygen and anchor the plants. Even though *Cassia* trees are easy to grow from seed and are tolerant to many soil types and salty drifts, determination of soil type required for good growth is necessary [10]. Since the native soil of Kuwait is predominantly sandy with localized hard layers occurring at various depths in the profile [11], it becomes necessary to optimize the technology for the production of pink shower and golden shower seedlings under the conditions of Kuwait and the present study was designed with the objective to determine the most efficient growing medium.

Corresponding Author: H.S. Al-Menaie, Arid Land Agriculture and Department of Greenery, Kuwait Institute for Scientific Research, P.O. Box: 24885, Safat 13109, Kuwait, Tel: (+965) 24989806.

MATERIALS AND METHODS

To study the effects of growing medium on the rate of growth of *Cassia nodosa* and *Cassia fistula* seedlings, a study was carried out in the greenhouse at the Kuwait Institute for Scientific Research (KISR) during 2008. The experiment was laid out in Complete Randomized Block Design (CRBD) with three treatments (soil mixtures) replicated five times and in each replication, five plants were tried. The mixtures were composed primarily of agricultural sand mixed with peat moss and potting soil (humus) at ratios of 1:1:1, 2:1:1 and 3:1:1 (T1, T2 and T3, respectively). Two-month-old seedlings of *Cassia nodosa* and *Cassia fistula* were transplanted in one-gallon plastic containers and kept in the greenhouse. The plants were transplanted very carefully without disturbing the root ball and irrigated daily with fresh water. Monthly fertilization was given with NPK @ 15:15:15 with trace elements (Mg, Fe, Zn, B, Mn, Mo) at the recommended rate of 2 g/l through irrigation water. Vegetative parameters i.e. plant height and number of leaves were recorded for a period of eight months from transplanting. Data on the effect of soil mixtures on the growth of the two species of *Cassia* were analyzed using R procedure for analysis of variance [12].

RESULTS

***Cassia nodosa*:** Among the various soil mixtures tried, sand: peat moss: potting soil in 1:1:1 ratio (T1) recorded the highest plant height compared to T2 and T3. At eight months after planting (MAP) the plant height recorded for T1, T2 and T3 were 92, 70.8 and 70.4cm respectively (Table 1). The results showed that there was a highly significant difference at $P \leq 0.001$ among the different treatments. Regarding the number of leaves produced, T1 recorded the highest number compared to T2 and T3. The number of leaves produced by T1, T2 and T3 were 370.20, 279.60 and 271.60 respectively at eight MAP. There was a highly significant difference at $P \leq 0.001$ between the different treatments tried.

***Cassia fistula*:** The study revealed that 1:1:1 soil mixture (T1) was the best in producing taller plants when compared to T2 and T3. Plant height recorded for T1, T2 and T3 were 85, 56.20 and 52.40 cm respectively at eight MAP (Table 2). There was a highly significant difference at $P \leq 0.001$ for plant height among the different treatments tried. Regarding the number of leaves, T1 was the best and produced highest number of leaves compared to T2 and T3. The number of leaves produced by T1, T2 and T3 were 88, 58.40 and 53,

Table 1: Plant height and number of leaves of *Cassia nodosa* under different soil mixtures

	Plant height (cm)					No. of leaves				
MAP	T1	T2	T3	Sig	SEM	T1	T2	T3	Sig	SEM
1	4.52	2.66	2.94	***	±0.18	29.48	10.76	10.32	***	±0.56
2	4.94	3.50	3.68	***	±0.30	52.92	19.96	20.20	***	±1.28
3	14.94	10.20	10.96	***	±0.56	159.72	119.20	110.32	***	±7.64
4	46.92	26.72	29.24	***	±3.33	293.32	226.92	214.04	***	±11.71
5	57.80	36.60	42.40	***	±1.01	311.40	241.80	227.80	***	±3.53
6	68.60	49.60	48.60	***	±0.81	320.80	258.40	242.60	***	±2.43
7	77.00	63.40	58.00	***	±2.10	339.60	271.20	258.00	***	±3.55
8	92.00	70.80	70.40	***	±.21	370.20	279.60	271.60	***	±4.64

MAP: Months after planting
***: Significant at P≤0.001
SEM: Standard error of means

Table 2: Plant height and number of leaves of *Cassia fistula* under different soil mixtures

	Plant height (cm)					No. of leaves				
MAP	T1	T2	T3	Sig	SEM	T1	T2	T3	Sig	SEM
1	7.88	4.46	4.04	***	±0.43	14.58	7.76	7.48	***	±1.48
2	10.32	5.84	4.66	***	±0.54	15.20	9.76	9.32	***	±1.53
3	17.80	9.48	9.64	***	±0.45	24.80	16.40	13.76	***	±41.34
4	41.40	13.76	17.76	***	±2.55	59.76	19.52	27.68	***	±3.18
5	47.40	22.00	20.00	***	±1.11	54.80	23.80	34.80	***	±2.42
6	58.80	33.80	33.00	***	±1.52	66.20	40.40	43.40	***	±3.03
7	70.40	47.80	47.80	***	±2.37	77.80	51.60	50.60	***	±2.27
8	85.00	56.20	52.40	***	±1.88	88.00	53.00	58.40	***	±1.76

MAP: Months after planting ***: Significant at P≤0.001 SEM: Standard error of means

respectively at eight MAP. Statistically the treatment effects were highly significant. These results are in agreement with those obtained by Ponnammal *et al.* [13] that a mixture of sand, soil and humus in the ratio of 1:1:1 exhibited higher germination in *Azadiracta indica* than either sand, red soil or black soil. The addition of organic matter in the form of peat can improve the physical status of soil for better root development because of increased aeration in the media [14]. Oluwole and Okusanya [15] and Okusanya *et al.* [16] found that humus significantly enhanced growth of *Tetracarpidium conophorum* and *Treculia africana* seedlings.

DISCUSSION

Results of this investigation indicated that plant height and number of leaves were higher in soil mixture which contained sand: peat moss: humus in equal proportions (1:1:1) for both *Cassia nodosa* and *Cassia fistula*. This could be attributed to the best combination of chemical and physical properties and ease of nutrient uptake by seedlings. Peat moss which is a natural organic soil conditioner can add body to sandy soil, save water by absorbing and holding moisture and reduces nutrient leaching. It also aerates plant roots by loosening heavy soil and increases the soil's capacity to hold water and nutrients by increasing capillary forces and cation exchange capacity. This is necessary when planting is done in an arid country like Kuwait with sandy soils, which need increased moisture content to flourish. Humus (potting soil), a reservoir of nitrogen and phosphorus is a vital component affecting soil fertility. It also absorbs water and act as moisture reserve that plants can utilize. Both 2:1:1 and 3:1:1 media produced seedlings with significantly lower heights than 1:1:1 medium. The reduction in growth of seedlings in 2:1:1 and 3:1:1 soil mixtures could be due to their higher proportion of sand. Higher levels of drainage and nutrient leaching in coarse textured sand could have led to low seedling growth.

Based on the results obtained from this study, it was concluded that the soil mixture containing sand: peat moss: potting soil in equal proportion (1:1:1) could be used as a standard potting media for *Cassia nodosa* and *Cassia fistula* to maintain satisfactory plant growth and development.

ACKNOWLEDGEMETS

The authors thank the Kuwait Foundation for the Advancement of Sciences and the Kuwait Institute for Scientific Research for their continued interest, encouragement and financial support during the investigation.

REFERENCES

1. Food and Agricultural Organization, 2004. AQUASTAT- Food and Agricultural Organization. Information system on water and agriculture. Available: http: //www.fao. org/ ag/ aglw/ aquastat/ countries/Kuwait.
2. Bhat, N.R. and H. Al-Menaie, 1999. Screening of selected plants for landscape beautification and greenery development in Kuwait. Kuwait Institute for Scientific Research, Report No. KISR 5512, Kuwait.
3. Al-Menaie, H.S., O. Al-Ragam, A. Al-Shatti, M. Mathew and N. Suresh, 2009. Introduction of flowering trees of the genus cassia for enhancement of greenery in Kuwait, phase I: introduction and evaluation. Kuwait Institute for Scientific Research. Final Report. KISR 9873, Kuwait.
4. Gower, S.T., 1987. Relations between Mineral Nutrient Availability and Fine Root Biomass in Two Costarican Tropical Wet Forests. Hypothesis Biotropica, 19: 171-175.
5. Gerhardt, K. and D. Frederickson, 1995. Biomass Allocation by Broad–Leaf Mahogany Seedlings, *Swietenia Macrophylla* (King), In Abandoned Pasture and Secondary Dry Forest in Guanacaste, Costa Rica. Biotropica, 27: 174-182.
6. Tinus, R.W. and S.E. McDonald, 1979. How to grow tree seedlings in containers in greenhouse. General Technical Report RM-60, Rocky Mountain Forest and Range Experiment Station, Forest Service, U.S. Dept. Agric., pp: 256.
7. Al-Menaie, H.S., N.R. Bhat and M. AboEl-Nil, 2006. Introduction, evaluation and propagation of argan tree for greenery and oil production in Kuwait, Phase I: introduction and propagation. Kuwait Institute for Scientific Research, Report No. KISR 8175, Kuwait.
8. Al-Menaie, H.S., A.A. Al-Shatti, A.A. and N. Suresh, 2008. Effect of Growing Media on Growth and Flowering Patterns of *Gardenia Jasminoides* under Arid Conditions. European J. Scientific Res., 24: 69-73.

9. European Committee for Standardization or Comité Européen de Normalisation, 1999. CR 13456 Soil improvers and growing media - labeling, specifications and product schedules. European Committee for Standardization, Brussels, pp: 50.
10. United States Department of Agriculture, 2005. Plant Database, Natural Resources Conservation Services (NRCS). Available at http://plants. usda. gov/ cgi_bin/tropics.cgi?earl=plant_profile.cgi and symbol=CAF13.
11. Omar, S.A.S., Y. Al-Mutawa and S. Zaman, 2007. Vegetation of Kuwait. Kuwait Institute for Scientific Research, pp: 34-159.
12. Crawley, M.J., 2005. Statistics an Introduction Using R. John Wiley and Sons Ltd. England, pp: 155-185.
13. Ponnammal, N.R., M.C. Arjunan, T. Gunamani and K.A. Antony, 1993. Germination and Seedling Growth of *Azadiracta indica* A. Juss. J. Tree Sci., 2(2): 65-68.
14. Wilson, S.B., P.J. Stoffella and D.A. Graetz, 2001. Compost-amended Media for Growth and Development of Mexican Heather. Compost Sci. Utilization, 9: 60-64.
15. Oluwole, S.O. and O.T. Okusanya, 1992. Ecological Studies on the Seedling Growth of the African Walnut, *Tetracarpidium conophorum*. J. Tropical Forestry and Sci., 6(2): 181-196.
16. Okusanya, O.T., O.O. Lakanmi and A.E. Osuagwu, 1991. Some Factors Affecting Seedling Growth and Survival of *Treculia africana*. J. Tropical Forestry and Sci., 491: 64-79.