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A Morphological and Physiological Study of *Jatropha curcas* Linn. Propagated from Seeds in Bangladesh

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Abstract: Pot experiments were carried out in Dhaka, Bangladesh to evaluate the morphological and physiological parameters of Jatropha, a second generation energy crop propagated from seeds. The leaves and petioles of Jatropha curcas plants were collected from the earthen pot to determine the leaf and petiole nutrient contents. So this study provides a reliable account of the endogenic concentrations of nutrients present in petiole and their content in leaves including the morphological parameters such as plant height, leaf growth, fresh and dry weight of leaves, petiole and root length of the plant at 2 vegetative growth stages grown in Silty clay loam soil were attempted. The experiment revealed that the morphological parameters responded better in mature plant compared to young plant but the physiological parameter showed variations at 2 growth stages.

Key words: Jatropha curcas · Height · Leaf · Root length and Nutrient uptake

INTRODUCTION

In recent years public attention has been focused on renewable sources of energy in both developed and developing countries all over the world. Biofuel, which is sometimes made from energy crops, is mainly a liquid or gas derived from biomass of organic plant material, second generation biofuel crops. These crops are not typically used for food purposes but can help supply a portion of the current fuel demand sustainably with minimum environmental impact [1]. The biomass can be converted to fuel and used for various transportation and household purposes. These agro-based fuels are considered an important means of reducing greenhouse gas emissions and increasing energy security by providing an alternative to conventional petroleum based fossil fuel.

Jatropha curcas L is one such second generation, drought resistant,biofuel crop. They can replace fossil fuels in developed as well as in developing countries like Bangladesh while bringing additional income to poor farmers. Moreover, the country has a large area of uncultivable wasteland which should be taken into consideration for propagating this important bioenergy crop to produce biofuel. As it is an easy to propagate drought resistant plant it can be cultivated on marginal land and wastelands, without competing with current food production [2,3]. As an oil bearing biomass feedstock, it can ensure an alternative source of energy and reduce our dependency on fossil fuel. This plant can grow anywhere including soil considered infertile for food production and can live for about 50 years [4]. The cultivation of jatropha species is also reported to prevent and control erosion [5].

The plant thrives on different soil types including gravelly, sandy and also under saline conditions [6]. Seed production ranges from about 0.1 tons per hectare per year (t/ha/year) to over 14 t/ha/year, [2,7-10]. The seeds contain about 30-35 percent of non-edible oil [2,5,11,12]. One hectare of land, depending on density, can produce 158-396 gallons of oil [13], as 0.26 gallon of oil can be extracted per 8.8 lbs [9] to 11-12 lbs of seeds [14]. The plant is important for climate change issues as a mature plant or tree absorbs around 18 lbs of carbon dioxide (CO_2) per year. So cultivating *Jatropha* in one hectare of land can sequester around 20 tons of CO_2 annually [15].

Jatropha curcas *L* is as a sustainable source of second generation biodiesel feedstock species and the overall supply can be increased with different propagation technologies. In addition, the plant can grow in drought and the land use patterns in Bangladesh are suitable for its cultivation [16]. Present investigation was undertaken to study some of the physiological and morphological parameters of Jatropha plant propagated from seeds and grown in earthen pot with silty clay loam soil.

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MATERIALS AND METHODS

The experiments were carried out with Jatropha curcas, at author's roof top garden, Dhaka, Bangladesh. Seeds were collected from Florida USA, sown on 1st April in poly bags having size of 22 x12 cm 2011 and germinated on 7th April 2011.Poly bags were filled with mixed soil and well decomposed farm yard manure in equal proportion in ratio of 1:1:1. The drainage holes were provided at the bottom of the polybags.

4 weeks seedlings were transplanted in 25 cm height and 30 com diameter clay pots. The pots were filled with silty clay loam soil. The field capacity of the soil was 33%. The soil was air dried and sieved through a 2 mm sieve for chemical and other analyses. The general characteristics of the soil were: Sand-5.8%, Silt-60.2%, clay-34.o%, Maximum water holding capacity-46%, Hygroscopic moisture-1.40%, Porosity-49%, Bulk Density-1.27g/cc, Particle Density-2.57g/cc, PH 7.2, EC-143uS, OM-1.14, CEC-17.9 meq/100g soil andc N-0.06%.

Plate 1: 7 days old seedling of Jatropha

Plate 2: 8 weeks old seedling of Jatropha

Plate 3: 8 months old Jatropha plant

Plate 4: Leaf with petiole of 8 weeks Plant

Plate 5: Leaves with petiole of 8 months old plant

The experiments were arranged to get all the plants in the pots with sufficient sunlight. Nutrient supply, water supply and other intercultural operations were done as and when necessary. Collection of petiole and leaves were done at 8 weeks and 8 months after transplanting. Other morphological data and physiological parameters at this two vegetative growth stages were also recorded.

Plate 6: Roots of 8 weeks old plant

Plate 7: Roots of 8 month old plant

Table 1: Morphological parameters of 8 weeks and 8 months Jatropha plant

Jatropha Plant	Plant height (cm)	Stem diameter (cm)	Leaf fresh wt (gm)	Petiole fresh wt (gm)	Leaf dry wt (gm)	Petiole dry wt (gm)	Leaf petiole length (cm)	Leaf length (cm)	Leaf width (cm)	Root Length (cm)	Root/shoot ratio
8 weeks old	26.67	1.27	2.61	1.48	0.56	0.013	11.68	13.46	11.43	15.74	0.70
8 months old	66	2.54	2.63	1.59	0.59	0.017	15.24	13.97	16.51	64.26	1.00

RESULT AND DISCUSSION

In the present study, the height and other morphological and physiological parameters of 8 weeks and 8 months of the plants were recorded. Results revealed that all the morphological parameter responded better in mature 8 months old plant compared to 8 weeks young plant (Table 1). But the physiological parameters like nutrient content showed variation at two growth stages. The percentage of Nitrogen and Sulphur were higher in 8 months old leaves but the concentration of potassium and phosphorus was lower compared to 8 weeks old leaves. But in case of petiole the percentage of all the nutrients were lower in mature plant except the Potassium content compared to young plant (Table 2-3).

Table 2: Physiological parameters of 8 weeks Jatropha plant

Samples	%N	%Crude protein	%P	%K	%S
Jatropha Leaf	1.02	6.37	0.24	0.53	0.12
Jatropha Petiole	1.92	12.0	0.34	0.57	0.18

Table 3: Physiological parameter of 8 months Jatropha plants

Samples	% N	%Crude protein	%P	%K	%S
Jatropha leaf	1.74	10.87	0.11	0.29	0.15
Jatropha Petiole	0.50	3.12	0.08	0.79	0.12

CONCLUSION

Vegetative growth and other physiological parameter of Jatropha curas L seedling were tested and the result showed that based on the measurement and analysis of the above-ground part of the seedlings at two growth stages in the pots, it is concluded that 8 months old plant has higher growth, crude protein and nutrient concentrations like nitrogen and sulphur compared to 8 weeks old seedling as it is not well-developed and the root shoot ratio of the young seedling was also lowered compared to the mature plant.

In conclusion mature plant shows better morphological parameters including the root/shoot ratio but has lowered some of the physiological parameters.

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