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Nursery Production Techniques for Argan (*Argania Spinosa* L.)

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Abstract

Efforts are being made to introduce and evaluate the potential of argan tree (*Argania spinosa* L.) a native of Morocco, for greenery applications under Kuwait's environmental conditions. As part of this objective, a number of techniques were tested to raise quality plantable seedlings in the nursery. The effects of different treatments, such as container type, planting medium and seed soaking on germination were assessed in this species. These experiments as well as the subsequent analysis indicated that a medium containing soil: peat moss: humus in the ratio of 2:1:1 v/v/v in 15cm plastic containers provided the optimum conditions for seed germination and initial seedling growth in argan.

Keywords: *Argania spinosa*, Greenery, Seedlings, Planting medium

1. Introduction

The argan tree (*Argania spinosa* L.) is a native species of Morocco which covers much of the southwest region of Morocco between Essaouira and Agadir. The area is characterised by dry, semi arid climatic conditions with an annual rainfall of less than 200 mm. Isolated colonies of argan are also found in the northeast of Morocco, on the side of Oujda, in the mounts of Blessed-Snassen [1]. The semi arid desert ecosystem provides a favourable environment in the establishment of the tree. Argan plays a vital role in the food chain and in the evolution of the ecosystem. The local Berber community extracts nutritious oil from its seeds which has scientifically proven dietary and cosmetic values. The tree possesses deep root system which protects the soil against soil erosion and controls desertification. The argan tree adapts well in a hostile environment and to irrigation with brackish water [2]. The tree which flourishes in such harsh climate presents a good potential for introduction to Kuwait which has more or less the similar climatic conditions and environment. The argan tree is considered to be

difficult to propagate, whether by seeds or by cuttings [3]. Scientific research on argan is limited and there is no proven technology for mass propagation of argan. The success of mass production of seedlings depends on nursery techniques as this is the only method to produce a large number of plantable seedlings in this species. Using a nursery for raising seedlings provides the opportunity to raise them under controlled conditions during the germination and subsequent establishment phase, shielding them from the vagaries of the weather outside and therefore paving the way for producing healthy plantable seedlings. This paper summarizes the effects of different soil medium, pot sizes and soaking treatments on germination and seedling growth of argan seeds under controlled conditions.

2. Materials and methods

2.1. Seed collection

The seeds were collected from Morocco by a team of scientists from KISR who went on two scientific missions to collect seeds as this ensured the seeds were from their natural habitat in Morocco. Other materials needed for the experiment like soil medium and plastic pots of different sizes were procured from the local market. The greenhouse facilities at KISR were utilized for the experiment.

2.2. Seed Treatments

Factors, such as pot size, soil medium and soaking of seeds play a crucial role in germination and growth of seedlings. Growing plants in pots help in monitoring the plant in controlled conditions.

The treatment combinations were as follows:

2.2.1. Pot Size

Polyethylene containers - 10 cm (P_{10})
Polyethylene containers - 15cm (P_{15})
Jiffy containers - 10cm (J_{10})

2.2.2. Soil Mixtures (SM)

Sand, Peat moss and Humus 1:1:1 by v/v (SM1)
Sand, Peat moss and Humus 2:1:1 by v/v (SM2)
Sand, Peat moss and Humus 3:1:1 by v/v (SM3)
Soil: Peat moss 1:1 by v/v (SM4)
Soil alone (SM5)

2.2.3. Seed Treatment

Pre sowing soaking for 24 hours (S^+)
Without pre sowing soaking (S^-) (Control without soaking)

2.2.4. Seed sowing

Seeds were sown manually in polyethylene containers at a depth of about 5 cm. The pots were irrigated copiously at the time of planting and later on at optimum level and the germination were observed regularly and recorded.

3. Experimental design and data collection

The experiment was conducted using split plot design with thirty treatments which were replicated five times. Each replication consisted of five containers each with five seeds (a total of 750 seeds sown in 150 containers). Data on germination was recorded on daily basis and the final germination was

calculated at the end of the experiment. The data were analyzed using the ANOVA procedure (R method).

4. Results

Germination started two weeks after sowing and spanned over a period of one month. Maximum germination was observed three weeks after sowing and tapering off thereafter (Table 1). The study indicated that the seeds sown in jiffy pots both in 2:1:1 (Soil: Peat moss: Humus) and 3:1:1 (Soil: Peat moss: Humus) medium showed the highest germination percentage of 96% and 92% respectively with no soaking. This was followed by 1:1:1 medium in jiffy pots and sand alone in polyethylene pots showing 88% germination.

Table 1: Effect of Container type, Medium and Soaking on Germination of Argan Seeds

Container Type	Medium Composition	Soaking Treatments	Total no of seeds germinated	Total Germination %
PE – 10 cm	3:1:1	No Soaking	19	68
		Soaking	19	64
	2: 1: 1	No Soaking	15	80
		Soaking	8	56
	1: 1: 1	No Soaking	20	76
		Soaking	22	76
	1: 1	No Soaking	20	64
		Soaking	14	56
	Sand Only	No Soaking	4	84
		Soaking	14	84
PE -15 cm	3:1:1	No Soaking	24	64
		Soaking	16	56
	2: 1: 1	No Soaking	17	16
		Soaking	16	56
	1: 1: 1	No Soaking	16	60
		Soaking	14	32
	1: 1	No Soaking	19	56
		Soaking	23	32
	Sand Only	No Soaking	16	60
		Soaking	14	88
Jiffy -10cm	3:1:1	No Soaking	14	76
		Soaking	8	92
	2: 1: 1	No Soaking	20	96
		Soaking	15	64
	1: 1: 1	No Soaking	21	80
		Soaking	21	88
	1: 1	No Soaking	15	80
		Soaking	22	60
	Sand Only	No Soaking	19	76
		Soaking	15	60
Significance at P < 0.05 – Pot size $(P)^2$			NS (1.7)	NS (34.6)
Medium (M)			NS (0.4)	NS (7.4)
Soaking (S)			NS(1.3)	NS(25.7)
P X M			NS (0.14)	NS (2.7)
P X S			NS (1.1)	NS (21.85)
M XS			NS (0.2)	NS (4.7)
P X M X S			NS (0.1)	NS (1.7)

PE= polyethylene containers; Jiffy = Jiffy containers

* Seeds were soaked in fresh water for 24 hrs prior or sowing.

** Seeds with 1 mm or longer plumule were considered as germinated.

The data were analyzed using the ANOVA procedure (R method). NS denotes no significance at P =<0.05. The standard Error of Mean is indicated in the parenthesis.

Table 2: Average of Shoot and Root Length of Argan Seedlings in Different Treatments at the Time of Transplanting

Container Type	Medium Composition	Soaking Treatments	Av. Root Length (cm)	Av. Shoot Length (cm)
PE -10cm	3:1:1	No Soaking	19.9	2.5
		Soaking	21.8	3.3
	2: 1: 1	No Soaking	17.9	2.0
		Soaking	18.3	3.0
	1: 1: 1	No Soaking	10.0	2.8
		Soaking	9.5	2.6
	1: 1	No Soaking	18.3	2.7
		Soaking	21.4	3.1
	Sand Only	No Soaking	11.9	2.0
		Soaking	12.1	2.5
PE-15 cm	3:1:1	No Soaking	10.4	2.2
		Soaking	11.6	3.7
	2: 1: 1	No Soaking	16.3	3.3
		Soaking	19.9	3.2
	1: 1: 1	No Soaking	12.4	2.5
		Soaking	18.0	3.8
	1: 1	No Soaking	9.3	2.3
		Soaking	11.1	3.1
	Sand Only	No Soaking	21.1	2.2
		Soaking	19.0	3.7
Jiffy -10cm	3:1:1	No Soaking	12.1	2.5
		Soaking	9.7	3.0
	2: 1: 1	No Soaking	10.5	1.9
		Soaking	12.0	2.1
	1: 1: 1	No Soaking	14.8	2.7
		Soaking	20.2	3.9
	1: 1	No Soaking	13.9	3.3
		Soaking	17.5	3.0
	Sand Only	No Soaking	9.3	2.0
		Soaking	6.9	3.0
Significance at $P < 0.05$ – Pot size $(P)^2$			** (9.8)	NS (2.6)
Medium (M)			NS (6.3)	NS (1.7)
Soaking (S)			NS (13.3)	** (3.5)
P X M			NS (2.9)	NS(0.8)
P X S			NS (6.1)	NS (1.6)
M XS			NS (4.0)	NS (1.1)
P X M X S			NS (1.9)	NS (0.5)

Seedlings from experiment 1 were transplanted in 15 cm polyethylene pots. Average of 25 plants (five replications each with 5 seedlings).

The data were analyzed using ANOVA Procedures (R method). NS denotes non significance at P = <0.05. The figures in the parenthesis represent standard error of mean.

5. Discussion

The study indicated that jiffy pot was the best container for germination of argan seeds. But the use of jiffy pots posed a difficulty at the time of transplanting. The success of transplanted seedlings rests on the time of transplanting. The optimum stage would be the period after the hardening of the two leaf stage. But during transplanting of argan seedlings, it was observed that the average root length was more than 15 to 20 cm (Table 2), with the roots penetrating the collapsible walls of the jiffy pots and entering the ground surface below. This resulted in mechanical injury to the tips of the tap root system making the seedlings susceptible to root rot fungi like *Fusarium oxysporum* and nematodes. Placing the pots over polythene sheets is an alternative but it was not a plausible solution with the risk of root exposure affecting the survival of young seedlings. Therefore, 10 cm polyethylene pots were selected as the correct pot size during germination phase as they offer sufficient moisture while avoiding the

risk of over crowding. The best soil medium for germination was Soil: Peat moss: Humus in the ratio 2:1:1.

The plants were transferred to 15 cm polyethylene pots which could retain more moisture for the seedlings during the growing phase. The medium used for the transplanted seedlings was Soil: Peat moss: Humus in the ratio of 3:1:1, the higher proportion of agricultural soil providing better drainage in the medium, thereby preventing excess moisture from accumulating around the root system. This process hardens the seedlings, makes them tolerant to a certain degree of stress and prepares for transplanting in the field conditions. Monthly observations on plant height and number of branches were taken which could provide better insight in to the growth pattern of the plant.

6. Conclusion

Breaking dormancy in argan seeds is the biggest challenge in propagation of argan. The physical characteristics of the seeds defy conventional seed treatment methods and techniques and 30% dormancy rate is the norm rather than an exception. In the light of this, a concerted and focused approach is needed to increase the germination potential as well as careful nurturing of the seedlings to maximize the survival rate of seedlings. Soaking of seeds in water before sowing, use of different pot sizes and medium during different stages of the plant in the nursery, all have a cumulative effect in the successful establishment of argan.

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