ASSESSMENT OF THE EFFECTS OF TEMPERATURE, BASE MEDIUM AND NURSERY CONTAINER ON THE GERMINATION AND GROWTH OF *JATROPHA CURCAS* SEED VARIETIES

Sylvia A. Henga.*

Abstract

Jatropha curcas is It is being primarily cultivated due to its usefulness as a biofuel and is normally propagated by seeds and cuttings, and commercial propagation used seeds as the main planting material. However, there's very scarce information regarding seed viability and growth and some literature indicate that the crop may take a very long period to grow. Studies on seed germination of Jatropha curcas were carried out in the greenhouse conditions to find out factors that may affect growth of the crop. Experiments were carried out in the greenhouse to assess the effect of plastic container and sand soil mixture, polythene cover and polythene container on germination of Jatropha curcas seed varieties. Variables measured included days to emergence, height, number of leaves and germination percentage The experiment used the completely randomized design (CRD). Data was analyzed by ANOVA to detect significant differences between means Results were subjected to analysis of variance using SAS statistical software. In the green house, the use of polythene cover and polythene container gave highest germination rates of 100% over plastic container and sand soil mixture treatments on 7 Jatropha curcas varieties. 26days old seedlings reached a mean height growth of 17.9cm, a proof that seedling growth was faster in covered containers than in the rest and sprouting followed the same trend.

Key words; *Jatropha curcas*, germination, seed, planting continer.

* Department of agricultural science and technology, Kenyatta University

Introduction

Jatropha curcas is normally propagated by seeds and cuttings, and commercial propagation used seeds as the man planting material. Some of the problems experienced in the production include low germination, poor seed viability, scanty and delayed rooting of seedlings and vegetative cuttings (Heller, 1996 & Openshaw, 2000). Hot and humid weather is preferred for successful germination of seeds. Seeds can either be taken through nursery production or sown directly n the field. Germination may be done in polythene bags or plastic papers. The medium for nursery growth may be soil, mixed with sand or manure. The question of germination and viability requires urgent attention if farmers are to benefit from the crop. This is because the information available is limited and unreliable, giving varying ideas on productivity, viability, germination potential, varieties that are questionable.

Good nursery work is the basis of successful afforestation activities and a probe into possible improvement techniques such as use of Sand, polythene bags and other practices may improve productivity. Good management of the nursery could possibly result in seedling production at the end of the first year itself. Nurseries supply seedlings to the farmers in their villages thus providing an alternative to the expensive seeds. Yet in order to guarantee good quality seedlings and survival in the field after planting, good nursery practices should be followed. To raise sufficient nursery stock, information on choice of site, soil medium and variety needs to be considered carefully, areas that the present study seeks to address. Some suggestions have been made to claim that the best result is saplings from seeds raised in a nursery in polythene bags, (about 3 - 4 months) which are planted just before the rainy season (Deven, 2007). The *depth of sowin*g also affects germination of plants. Sowing too deeply results in a seed that has only enough food within itself for a limited period of growth and a tiny seed sown too deeply soon expends that energy and dies before it can reach the surface (Rocal & Arlt, 2005) Some perennials and tree and shrub seeds can be very slow and erratic in germination. This may sometimes be due to *seed dormancy (*Berlin, 2000*)*; a condition which prevents the seed from germinating even when it is perfectly healthy and all conditions for germination are at optimum (Takayama, 2005). The natural method is to sow the seeds out of doors somewhere where they will be sheltered from extremes of climate, predators, etc. and leave them until they emerge, which may be two or three seasons later. Dormancy, however, can be broken through artificial means (Huibo, 2001). Some seeds, e.g. Sweet peas, ipomoea etc., have hard seed coats which prevent moisture being absorbed by the seed. All that is needed is for the outer surface to be scratched or abraided to allow water to pass through. This can be achieved by chipping the seed with a sharp knife at a part furthest away from the 'eye', by rubbing lightly with sandpaper or with very small seed pricking carefully once with a needle etc(Smith, 1992). Soaking is beneficial in some ways, for instance it can soften a hard seed coat and also leach out any chemical inhibitors in the seed which may prevent germination. 24 hours in water which starts off hand hot is usually sufficient. Seeds of some species (e.g. Cytisus, Caragana, Clianthus) swell up when they are soaked. If some seeds of a batch do swell within 24 hours they should be planted immediately and the remainder pricked gently with a pin and returned to soak. As each seed swells it should be removed and sown before it has time to dry out (Shrivastava, 2002). Some seeds need a period of moisture and cold after harvest before they will germinate-usually this is necessary to either allow the embryo to mature or to break dormancy (Takanyama, 2005). This period can be artificially stimulated by placing the moistened seed in a refrigerator for a certain period of time (usually 3- 5 weeks at around 41 F). With tiny seeds it is best to sow them on moistened compost, seal the container in a Polythene bag and leave everything in the refrigerator for the recommended period. However, larger seeds can be mixed with 2-3 times their volume of damp peat, placed direct into a Polythene bag which is sealed and placed in the refrigerator. The seeds must be moist whilst being pre-chilled, but it doesn't usually benefit them to be actually in water or at temperatures below freezing (Huibo et.al 2006). Light also seems to be beneficial after prechilling and so pre-chilled seeds should have only the lightest covering of compost over them, if any is required, and the seed trays etc. should be in the light and not covered with brown paper etc. Some seeds have a combination of dormancy's and each one has to be broken in turn and in the right sequence before germination can take place (Rost & Thomas, 2004).

Seeds are widely used as planting material by many farmers who cultivate *Jatropha curcas*. However, sources reveal that plants from seeds produce after 2-3 years from planting date (Hikwa et.al, 1997). Other observations show that they may yield after 2-4 years of planting depending on environmental conditions (Singh, 2008). Seeds have limited viability and loose almost 50% viability within 15 months of harvest. Propagation from seeds also leads to genetic variability and makes the crop prone to diseases (Ginwal & Shrivastava.2004)

Vegetative propagation offers the advantage in developing true to type disease free varieties of economic and commercially important plants for clonal multiplication. (Shujantha, 2005). Certain character studies suggested that species from one region might vary in their growth rates possibly due to altitude, temperature, soil conditions and rainfall (Ginwal &Shrivastava 2004)

Materials and methods

Greenhouse seed trials involved use of pots, soil, sand, polythene bags which were purchased from supermarkets in Nairobi and were of size 8x12 inches.

Experimental Design

The exp used the completely randomized design (CRD). Data was analyzed by ANOVA to detect significant differences between means. Means differing significantly were compared using Duncan's Multiple Range Test (DMRT) at 5% probability level. Variability of data was expressed as mean+standard deviation.

Seven seed varieties were tested for germination under four sets of treatment in the first experiment. Treatment one involved planting seeds in plastic container filled with soil and covered with polythene bag. Treatment two involved planting seeds in plastic container filled with half soil and half sand, treatment three had seeds planted in polythene bags filled with soil and the final treatment which acted as control had seeds planted in plastic containers filled with soil. Seeds were planted at the same depth, watered at equal intervals. Each of the treatments was replicated four times.

Measurements

Measurements of heights, number of days to germination, percentage germination, number of leaves and was made. A 30cm ruler was used to take the measurements for height while the number of days germination were measured by observing the time of sprouting of seeds or emergence of explants. The number of leaves produced were observed and counted. All the records were taken and kept in a notebook.

Results and analysis

The earliest emergence was observed on day 10 and the latest on day 26. In this set up, the variety type significantly ($p \leq 0.05$) affected the days to emergence such that there were differences across the varieties. The application of different treatments had a significant ($p \leq 0.05$) effect on the days to emergence as shown in table 2(a) and figure 7 below. There was no significant interaction between variety and treatment levels ($p \geq 0.05$). Seeds germinated in the polythene bags and those covered using plastic bags emerged earliest. The highest mean height of 17.9cm was obtained from seeds that were germinated in the covered containers while the lowest mean of4.3cm was obtained from seeds planted in soil/manure mixture. The variety type significantly ($p \leq 0.05$) affected the length of stems such that there were differences across the varieties. The application of different treatments also had a significant ($p \leq 0.05$) effect on the length of stems as shown in table 2(b) and figure 8 below. However, there was no significant interaction between variety and treatment levels ($p \geq 0.05$).The variety type did significantly affected the number of leaves produced($p \leq 0.05$). The application of different treatments had a significant ($p \leq 0.05$) effect on the number of leaves as shown in table 2(c) and figure 9 below. There was no significant interaction between variety and treatment levels. The effect of the treatments on the percentage germination was significant as shown in figure 2(d) below. The type of variety also did significantly affect the percentage germination ($p \leq 0.05$). The interaction between the variety and treatment was also significant ($p \leq 0.05$). The highest mean percentage germination was 100% and obtained from seeds germinated in plastic containers while the lowest percentage (mean=25%) was obtained from seeds germinated in polythene bags and manure/soil mixture.

Discussion

The use of nurseries to germinate seeds before transplanting to the field is very important and an essential part in producing plants such as Jatropha curcas. Apart from environmental aspects, other factors such as soil type and containers/pots used may affect the both germination and growth rates. The present study confirms that using polythene bags as container and covering plants with a plastic paper has a positive effect and gives the earliest days to emergence compared to the plastic container, sand/soil mix and manure treatments. This could be explained by the fact that plastic bags conduct a lot of heat which increases the soil temperatures. The high temperatures, then increase the rate of physiological reactions in the plants and this is translated into increased germination and growth (Demosthenis, 2000). In addition Jatropha is a heat loving plant that thrives well in high temperature conditions (Grim, 1996).

The covered containers also resulted in seedlings with the highest stem lengths, a result which confirms that temperature proportionately affects growth, through an influence on the rates of photosynthesis and translocation.

Although the use of cover on containers resulted in increased emergence and growth, the percentage of plants that germinated under this treatment was lowest, with a mean of 25%. There was probably so much heat in the covered containers that could have destroyed the seeds and reduced their viability. Interestingly, the seeds planted normally in plastic containers (control) gave the highest mean percentage of 100% with respect to the TZ Arusha variety.

Table 1 Mean number of days to emergence of seven Jatropha curcas seed varieties germinated in the greenhouse as affected by use of polythene container, plastic container, covering, sand/soil mixture and manure treatments.

Variety	Days to emergence				
	Polythene container.	Plastic	Covered	Sand/soil	Manure
TS Morogoro	10	15	10	13	15
T3 Tanga	11	16	10	14	24
Zanzibar	13	17	13	17	21
Pemba	11	16	14	18	19
TZ Arusha	11	13	12	19	25
T6 Dar	12	17	14	20	20
Arusha	12	18	10	21	24
LSD	2.84				

Table 2 Mean stem length of seven Jatropha curcas seed varieties germinated in the greenhouse as affected by use of polythene container, plastic container,covering, sand/soil mixture and manure treatments.

Variety	Length of stem				
	Polythene container	Plastic container	Covered	Sand/soil	Manure
TS Morogoro	12.6	7.9	12.6	4.8	4.3
T3 Tanga	13.0	8.2	14.0	6.1	5.1
Zanzibar	13.9	8.3	13.8	6.7	5.8
Pemba	16.2	9.1	17.9	9.2	5.7
TZ Arusha	17.6	7.1	16.3	8.9	7.1
T6 Dar	17.2	9.6	17.2	8.6	5.9
Arusha	15.6	9.0	13.6	8.9	7.3
LSD	1.35				

Table 3 Mean number of leaves of seven Jatropha curcas seed varieties germinated in the greenhouse as affected by use of polythene container, plastic container, covering, sand/soil mixture and manure treatments.

Variety	Number of leaves				
	Polythene container	Plastic container	Covered	Sand/soil	Manure
TS Morogoro	3	2	3	2	3
T3 Tanga	3	2	3	2	3
Zanzibar	3	2	3	2	3
Pemba	3	2	3	2	3
TZ Arusha	3	3	3	2	3
T6 Dar	3	2	3	2	3

Arusha	3	3	2	3	3
LSD	0.31				

Table 4 Mean %germination of seven Jatropha curcas seed varieties germinated in the greenhouse as affected by use of polythene container, plastic container, covering, sand/soil mixture and manure treatments.

Variety	%germination				
	Polythene container	Plastic container	Covered	Sand/soil	Manure
TS Morogoro	68.8	37.5	68.8	43.8	25.0
T3 Tanga	43.8	56.3	37.5	31.3	43.8
Zanzibar	87.5	75.0	62.5	75.0	37.5
Pemba	62.5	62.5	50.0	68.8	25.0
TZ Arusha	93.8	100.0	93.8	93.8	56.3
T6 Dar	25.0	37.5	37.5	37.5	25.0
Arusha	58.8	37.5	75.0	48.8	50.0
LSD	11.40				

Analytical program used: Statistical analysis systems (SAS)

Mean separation by : Least Significant Difference (LSD)

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