EFFECTS OF SEED PROVENANCE ON PLANT ESTABLISHMENT INDEX, SEEDLING VIGOR INDEX AND SPEED OF GERMINATION OF PHYSIC NUT (*Jatropha curcas L.*) IN SOKOTO STATE, NIGERIA

Abstract
The study on effects of seed provenance on plant establishment index, seedling vigor index and speed of germination of *Jatropha curcas L.* was carried out during the 2019 raining season, at the Teaching and Research Farm, Shehu Shagari College of Education Sokoto, Nigeria, *Jatropha* seeds were collected from different live hedges of the plant in the State, from four local government areas in each of the senatorial districts. The treatments consisted of 16 different accessions of the *Jatropha*. Laid out in a completely randomized design, replicated three times. The experimental land was ploughed manually using hand hoe and leveled using rakes. 15 rows of ridges at 0.5m apart were constructed. Seeds were planted in June, 2019 through dibbling. 2 seeds per hole at a spacing of 0.5 x 0.5m. Which were later on thinned to a plant per stand after germination. Fertilizer was applied at one month after planting (IMAP). The data collected was subjected to the analysis of variance (ANOVA), using the statistical analysis system (SAS, 2003). Significant differences in the treatments means were separated using the Duncan's New Multiple Range Test (DMRT). The result obtained indicated statistically significant ($P<0.05$) variations among the different seed accessions on the parameters observed at the various periods of the observation. The seed accessions at the SE1, SE3 and SW3 performed better over and above all the others from the rest of the seed accession sources investigated. Therefore it can be recommended for the environment of the study area for a maximum production dividend to the farmers and the other stakeholders in the production enterprise of the crop.

Key Words: Physic nut, seed provenance, plant establishment, seedling vigour.

INTRODUCTION

Jatropha nut also referred to the physic nut, purge nut or pig nut, is derived from a Greek word, which means 'Doctor' and *trophe*, which means nutrition (Hella, 1996). It is a perennial shrub which originates from the Central America (Aponte, 1978), which later spread to other tropical and sub-tropical countries as wild plant.

Jatropha grows on wide range soil types (Srivastova, 1999) but it requires a well-drained soil and it is adaptable to low fertility, alkaline soil, marginal lands and degraded soils (Open Shawn, 2000). Therefore can be grown without competing with food production (Heller, 1996). Although not a native to Africa, Hannin (2008) reported that it is fairly well established in many parts of the continent (Tanzania, Mali, Zimbabwe, Botswana, Malawi, South Africa, Nigeria, Ghana etc.) as a live defense/hedgerow and for medicinal purposes, in Nigeria Jatropha is found growing as a live fence/hedgerow or as a wild plant with different local names, which show that it is spread throughout the country. In Hausa language, it is

called Bini da zugu or ci ni da zugu, kmal-kwalaje in Fulfulde, lapa-lapa in Yoruba, kashain Nupe okwenwe in Igbo or neheogba (Ado and Abubakar, 2008).

Depending on the species, germination response of seed varies according to geographical and environmental factors viz latitude, elevation, soil moisture, soil nutrients, temperature, kind and diversity of plant cover, degree of habitant disturbance of the soil where the plant matures (Heller, 1996; Ginwal *et al.*, 2005). Kaushik *et al.*, (2007) studied variability in the seed trait of 24 curcas accession and observed significant differences in the seed germination and seedling growth of the *Jatropha*. Despite the economic importance of *Jatropha*, its potentials in commercial production remains under exploited due to absence of improved technologies. Therefore, there is a need to develop agronomic technologies for mass propagation and improved productivity. The objective of the study is to determine the best seed accession/provenance of *Jatropha curcus L.* plant from the four local government areas of the three senatorial districts of Sokoto state, Nigeria, with respect to plant establishment, seedling vigor and speed of germination of the crop.

MATERIALS AND METHOD

Experimental Site

The trial was conducted during the 2019 cropping season at the fruits and vegetable teaching and research farm at latitude 13°7" longitude 5°12" E, 278m ASL), Department of agricultural Science, Shehu Shagari College of Education Sokoto in the Semi-arid Sudan Savanna) agro-ecological zone.

Treatment and Experimental Design

Treatment consisted of 16 different accessions to Jatropha laid out in a completely randomized designed with three replications.

Cultural Practices

Jatropha seeds were randomly collected from 16 live hedges of the plant in Sokoto State. Drawn from four local government areas in each of the three senatorial districts of the state. Comprising Sokoto South, Wamakko, Kware and Binji Local government areas (Sokoto Central); Bodinga, Yabo, Shagari and Tambuwal local government areas (Sokoto West) and Gwadabawa, Goronyo, Isah and S/Birni Local government areas (Sokoto East). The sample-seed accession collected were sundried properly and fumigated with the nuval

chemical, stored bags and leveled to maintain identity. A uniform seed treatment was given to all the accessions' seed samples prior to sowing on the field, by soaking the seeds in water for 12 hours and later sown directly in the field.

i. **Land Preparation**

The experimental land was ploughed manually using the hand hoe and leveled with a rake, 15 rows of ridge at 0.5m apart were constructed.

ii. **Planting**

Seeds were planted in June 2019 through dibbling 2 seeds per hole at a spacing of 0.5 x 0.5cm was later thinned to one plant per stand.

iii. **Weeding**

Weeding was carried out at one month after sowing by using a hand hoe.

iv. **Watering**

Watering was carried out after every two weeks using watering can.

v. **Fertilizer Application**

Fertilizer was applied at one month after planting (45kg N, 60kg P2 05, 150kg K20/ha (Kaushik, 2007 through ring application method at a depth of 5cm and 15cm away from the plant (Anon, 2006).

Soil Sampling and Analysis

To determine the physico-chemical properties of the soil at the experimental site, soil samples were randomly collected from at 0 – 50cm and 50 – 100cm depth. The samples were subjected to routine analyses.

Data Collection

i. **Germination Index** was calculated as described in the association of seed analyst (AOSA, 1991), by the following formula:

$$\text{Germination index} = \sum (6T/Tt) \text{ or } \left(\frac{\text{No of germinated seeds}}{\text{Days of first count}} \right)$$

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ii. **Seedling Vigour Index**. This was calculated using the following formula:

$$\text{Seedling vigour index (SVI)} = \frac{\text{Seedling length (cm) x germination seedling}}{100}$$

iii. **Speed of Emergence**: This was calculated in accordance with the following formula:

$$\text{Speed of emergence} = \left(\frac{\text{No of seedling emerged at 5 days after sowing}}{\text{No of seedlings emerged at 15 days after sowing}} \right) \text{X } 100$$

iv. **Establishment Count:** Stand count was taken at one month after sowing by counting all the plants in each treatment at one month after planting

Data Analysis

The data collected were subjected and analysis of variance (ANOVA) procedure completely block design (RCBD) using statistical analysis system (SAS, 2003) , wherewith, the significant differences in the treatment means were separated using the Duncan's New Multiple Range Test (DNMRT).

RESULTS AND DISCUSSION

Effects of seed provenance on plant establishment, germination index, seedling vigour index and speed of germination of Jatropha is presented on table 1. Results indicated significant (P>0.05) variation among the different seed sources on plant establishment, germination index, seedling vigour index and the speed of germination of *Jatropha curcas L.*. The significant differences in plant establishment indicted that SW3, SE1 and SC2 did establish significantly higher than those of the other seed accessions. Whereas a significant germination index and seedling vigour index was also recorded at SE1 than the other seed accessions. While the SC3 and SC4 recorded the lowest germination index and seedling vigour index respectively. Similarly, a significant speed of emergence that was statistically similar was recorded at all the seed accessions. Performance of the SE1 could be attributable to the seed weight, speed germination, seedling vigour index and germination index obtained earlier. Which resulted to the significant plant establishment. This agree with the finding of Okoro (1976), Ginwal and Gera (2000) and Roy *et al.,* (2004) who reported that seed source with a higher germination value will also have a better field performance.

Table 1: Effect of seed provenance on plant establishment germination index seedling Vigour index and speed of germination *Jatropha curcas L.*

Accession	Source	Plant Establishment	Germination Index	Seedling Vigour Index	Speed of Emergence

SC1	S/South	3.00bcde	9.16bc	10.63bcd	61.09ab
SC2	Wamakko	4.33ab	8.26bc	15.52b	56.53ab
SC3	Kware	2.00de	4.31e	5.92de	50.00b
SC4	Binji	2.33de	2.49f	4.27e	50.00b
SW1	Bodinga	4.33ab	7.25d	13.17bc	53.33b
SW2	Yabo	2.67cde	7.60de	9.87cd	56.67ab
SW3	Shagari	4.67a	9.57b	13.72bc	72.22ab
SW4	Tambuwal	2.00de	8.96bcd	9.76cd	56.56ab
SE1	Gwadabawa	4.67a	11.13a	23.30a	91.67a
SE2	Goronyo	2.33de	9.45b	13.10bc	56.56ab
SE3	Isah	4.00abc	8.61bcd	12.02bc	80.33ab
SE4	S/Birni	3.33abcd	9.05b	9.60cd	91.67a
SE±		0.439	0.519	1.614	80.56ab
Significance	*	*	*	*	73.33ab

Means in a column followed by same letter (s) are not significantly different (P>0.05) NS = Not Significant* = Significant at 5% level NS = Not Significant MAP = month after planting.

CONCLUSION

Seed provenance on plant establishment index seedling vigor index and speed of germination had significant influence on the *Jatropha Curcas L.* from the study area. Thus, a conclusion can be drawn that the seed accessions at the SE1, SE3 and SW3 performed exceedingly better over and above all the others from the rest of the seed accession sources. Therefore, can be recommended for the environment of the study for maximum productivity of the crop and production dividend to the farmers and the rest other stakeholders in the production enterprise.

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