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Growth and rate of Biomass accumulation study of *Mucuna pruriens* (L.) DC (Velvet bean) in Ibadan, Nigeria

Adeniji[1*], A.O. and Awodoyin[1], R.O.
[1]Department of Crop Protection and Environmental Biology, University of Ibadan, Nigeria

*Corresponding Author's E-mail: adeniji.ayobami@yahoo.com

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ABSTRACT

Velvet bean is a twining annual legume that thrives in tropical and sub-tropical regions of the world. It improves soil fertility by fixing atmospheric nitrogen and is effective in the management of some noxious weeds. The growth attributes of velvet bean has not been sufficiently studied for its potentials in low-external input agriculture. Therefore, the growth and rate of biomass accumulation of two varieties of *Mucuna pruriens* plants was examined in Ibadan, Nigeria. Seeds of two varieties of *Mucuna pruriens* (Black Utilis and Semilas Cream) were sown separately in pots containing 5 kg soil at 1 seed/pot to assess growth and biomass attributes. Vine Length (cm), Percentage Effective Root Nodules, Shoot Dry Weight (g), Number of Trifoliate-Leaves and Number of Root Nodules were determined at maturity (20 Weeks After Sowing). Data were analysed using t-test. Vine Length, Percentage Effective Root Nodules and Shoot Dry Weight of 332.46±5.14, 66.03±3.31 and 35.20±0.47 of Black Utilis were significantly higher ($P<0.05$) than 289.66±5.48, 53.89±2.08 and 30.35±0.35 of Semilas Cream, respectively. The Number of Trifoliate-Leaves of Black Utilis was 40.00±0.58 while that of Semilas Cream was 39.00±1.15. The Number of Root Nodules of Black Utilis was 5.00±1.00 while that of Semilas Cream was 7.00±1.73. Black Utilis performed better than Semilas Cream based on assessment of growth and biomass attributes.

Keywords: Legume, *Mucuna pruriens*, black utilis, semilas cream, root nodules

INTRODUCTION

Velvet bean (*Mucuna pruriens* (L.) DC.) is a twining annual plant, belonging to the Fabaceae family. The legume thrives in tropical and sub-tropical climates of the world (Lucia *et al*., 2011). According to Eze *et al.* (2017), velvet bean is also known as devil bean, cowitch and cowhage. It is often referred to as "werepe" in Southwestern Nigeria due to its irritant (itching) properties of the dry pods.

The young plant is almost totally covered with fuzzy hairs, while the old plant is hairless (Sahaji, 2011). The plant's branches are long and thin while the leaves are trifoliate, alternating or spiralling with gray-silky underside (Agharkar, 1991). The flowers are either purple or white in colour, and have characteristics bent petals (Agharkar, 1991). The pods are thickly covered with stiff hairs (Lucia *et al*., 2011). Seeds are spherical, lustrous black or brown with a length of 0.12cm. (Verma *et al*., 1993). The seed germination is hypogeal (Baligar and Fageria, 2007). To get maximum yield in terms of biomass and pod production, staking is necessary. Kavitha and Thangamani (2014) buttressed the earlier assertion by attributing 25% increase in the yield of *Mucuna pruriens* and reduction in pest infestation to staking.

The legume plays important roles in crop production. It improves the soil fertility by fixing atmospheric nitrogen (Loks *et al.,* 2016) and enhances the availability of nutrient by modifying the diversity and interactions of soil biota (Blanchart *et al*., 2006; Ortiz Ceballos *et al*., 2007). It is also effective in the control of noxious weeds such as spear grass and rigid ryegrass (Udensi *et al*., 1999; Ochekwu and Udensi, 2015; Travlos *et al*., 2018). Plant-parasitic nematodes have been reported to be controlled by the legume (Chavarrıa-Carvajal and Rodrıguez-Kabana, 1998; Adediran *et al*., 2005; Blancharta *et al*., 2006)

The growth attributes of velvet bean needs to be studied for its potentials in low-external input agriculture. Therefore, the study was conducted to examine the growth and rate of biomass accumulation of two varieties of *Mucuna pruriens* plants in Ibadan, Nigeria.

MATERIALS AND METHODS

The experiment was carried out at the Screen House, Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan in 2019 and 2020. The developmental stages of two varieties of *M. pruriens* (semilas-cream and black-utilis) were monitored for a period of twenty (20) weeks. Two viable seeds each of the two varieties of *M. pruriens* was sown in experimental pots containing 5 kg soil each. The experimental pots were arranged in a completely randomized design. The seedlings were thinned to one seedling per pot at two weeks after sowing and the plants were watered daily. Destructive sampling was done fortnightly with three plants of each of the two varieties randomly selected for assessment of growth and dry matter accumulation. Data were collected on vine length (cm) using a meter rule, numbers of trifoliate leaves per plant (by counting), numbers of root nodules per plant (by counting), percentage effective root nodules per plant (by dissecting each nodules), and shoot dry weight.

The percentage effective root nodules were calculated by:

Percentage effective root nodules =

$$\frac{\text{Total number of effective root nodules}}{\text{Total number of root nodules}} \times 100$$

The biomass accumulation was assessed with the careful removal of roots of plants in selected pots by immersing the roots with ball of earth in bucket of water. Each plant was then detached into above and below ground portions, encased and dehydrated at 80°C to an unabating weight in Gallenkemp oven. The oven dehydrated plant was weighed on a mettle top-loading balance (Mettler P1210). At maturity, data were collected on numbers of flowers per plant (by counting) and numbers of pods per plant (by counting)

RESULTS

Weather information of Ibadan in 2019 and 2020

Figure 1 shows the monthly rainfall for Ibadan in 2019 and 2020 according to Meteorological Section of Department of Soil Resources Management, University of Ibadan. Major rainfall peaks was observed in September and October in 2019, June and October in 2020. The average monthly temperature ranged from 25.00 °C in July to 28.1 °C in February of 2019. In 2020, it ranged from 24.50 °C in August to 28.60 °C in March (Figure 2). The relative humidity ranged from 69.50% January to 86.00% June of 2019. It ranged from 53.90% in January to 83.90% in July of 2020 (Figure 3)

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Vine length

Generally, vine length increased with increasing number of weeks after sowing (WAS). In the first trial, the vine length of black-utilis was significantly higher (P≤ 0.05) than semilas-cream at 4, 6, 8, 10, 14 and 20 WAS only (Figure 4.5). In the second trial, the vine length of black-utilis was significantly higher (P≤ 0.05) than semilas-cream at all WAS except 2 and 10 WAS (Figure 4).

Number of trifoliate leaves

The highest number of trifoliate leaves of black-utilis and semilas-cream was observed at 16 WAS in the first trial. The number of trifoliate leaves of black-utilis was significantly higher (P≤ 0.05) than semilas-cream at 12 and 14 WAS only in the first trial. However, in the second trial, at 12 WAS, black utilis recorded the highest number of trifoliate leaves. At 14 WAS, semilas-cream recorded the highest number of trifoliate leaves. The number of trifoliate leaves of black-utilis variety was significantly higher (P≤ 0.05) than semilas-cream variety at only 10, 12 and 14 WAS (Figure 5).

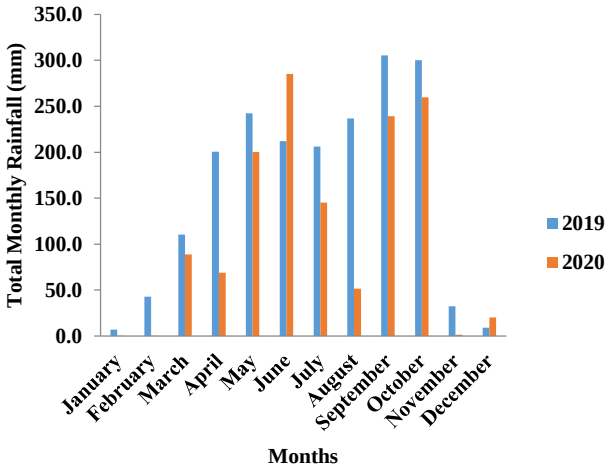


Figure 1: Total monthly rainfall (mm) during the period of study (2019-2020)
Source: Meteorological Section of Department of Soil Resources Management, University of Ibadan

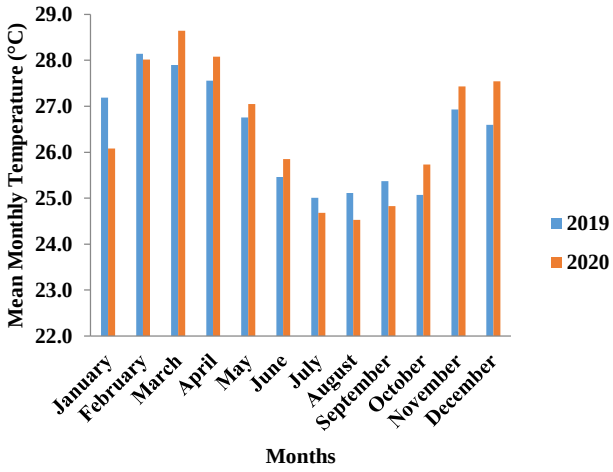


Figure 2: Total Monthly Temperature (°C) during the period of study (2019-2020)
Source: Meteorological Section of Department of Soil Resources Management, University of Ibadan

Number of root nodules

In the first trial, highest number of root nodules of black-utilis was recorded at 14 WAS and semilas-cream at 10 WAS. The number of root nodules of black-utilis was significantly different (P≥0.05) from semilas-cream at all WAS except 12, 18 and 20 WAS. In the second trial, the highest number of root nodules of black-utilis was observed at 10 WAS and semilas-cream at 12 WAS. The number of root nodules of black-utilis was significantly higher (P≥0.05) than semilas-cream at only 10 and 18 WAS (Figure 6).

Percentage effective root nodules

The highest percentage effective root nodules in black-utilis and semilas-cream were observed at 6 WAS in the first trial (Figure 4.10). Percentage effective root nodules of black-utilis was significantly

higher (P≤ 0.05) than semilas-cream all WAS except 12 and 14 WAS. In the second trial, the highest percentage effective root nodules of black-utilis was observed at 6 WAS and semilas-cream at 4 WAS. The percentage effective root nodules of black-utilis was significantly higher (P≥0.05) than semilas-cream variety at 6 WAS only (Figure 7).

Shoot dry weight

The shoot dry weight of black-utilis and semilas-cream increased with increasing WAS. Results obtained showed that in both trials, shoot dry weight of black-utilis was significantly higher than (P≤ 0.05) semilas-cream at 16, 18 and 20 WAS only (Figure 8).

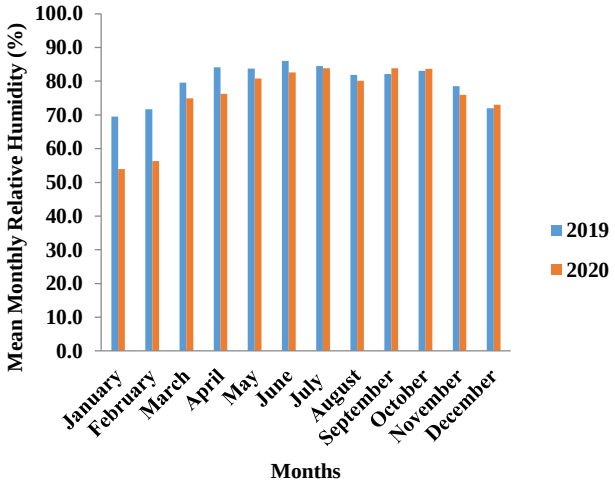
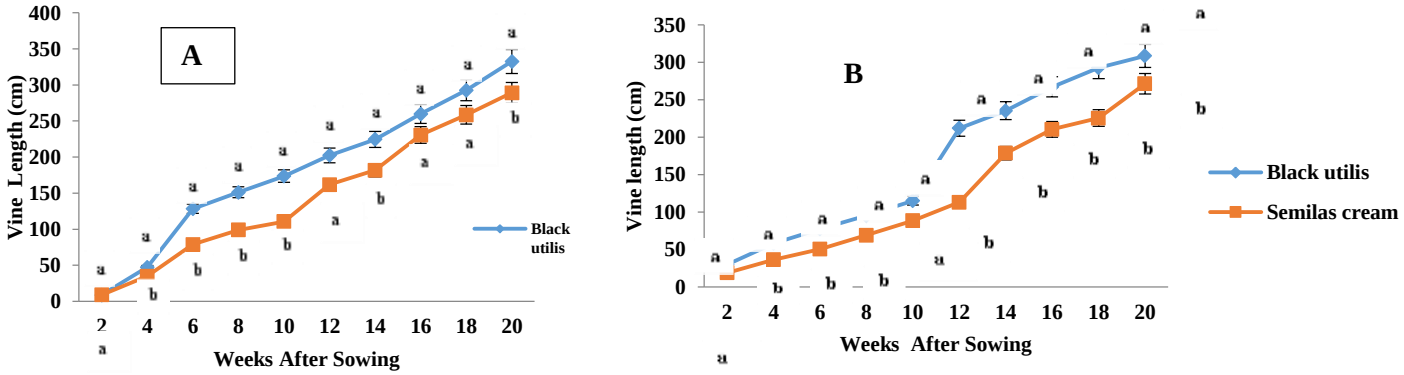
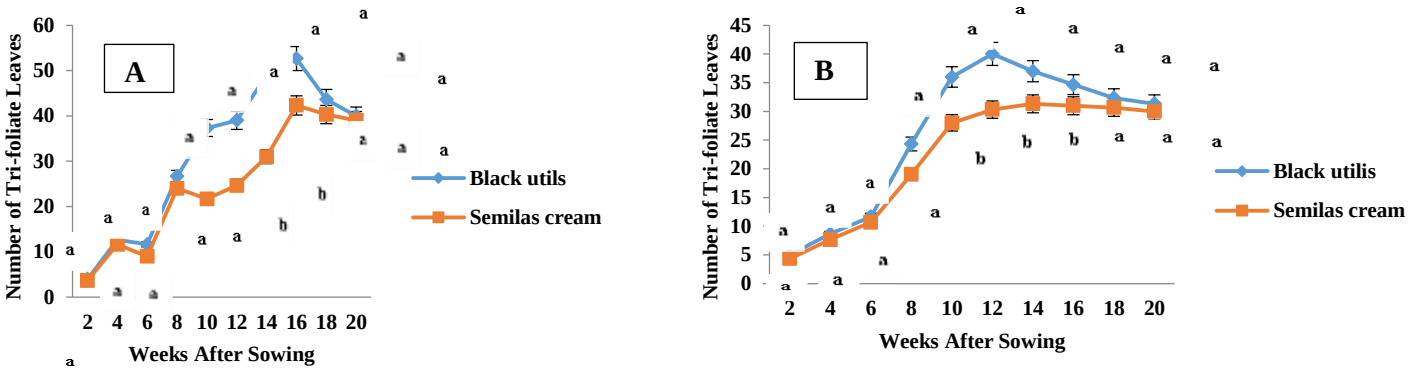


Figure 3: Total Monthly Relative Humidity (%) during the period of study (2019-2020)
Source: Meteorological Section of Department of Soil Resources Management, University of Ibadan



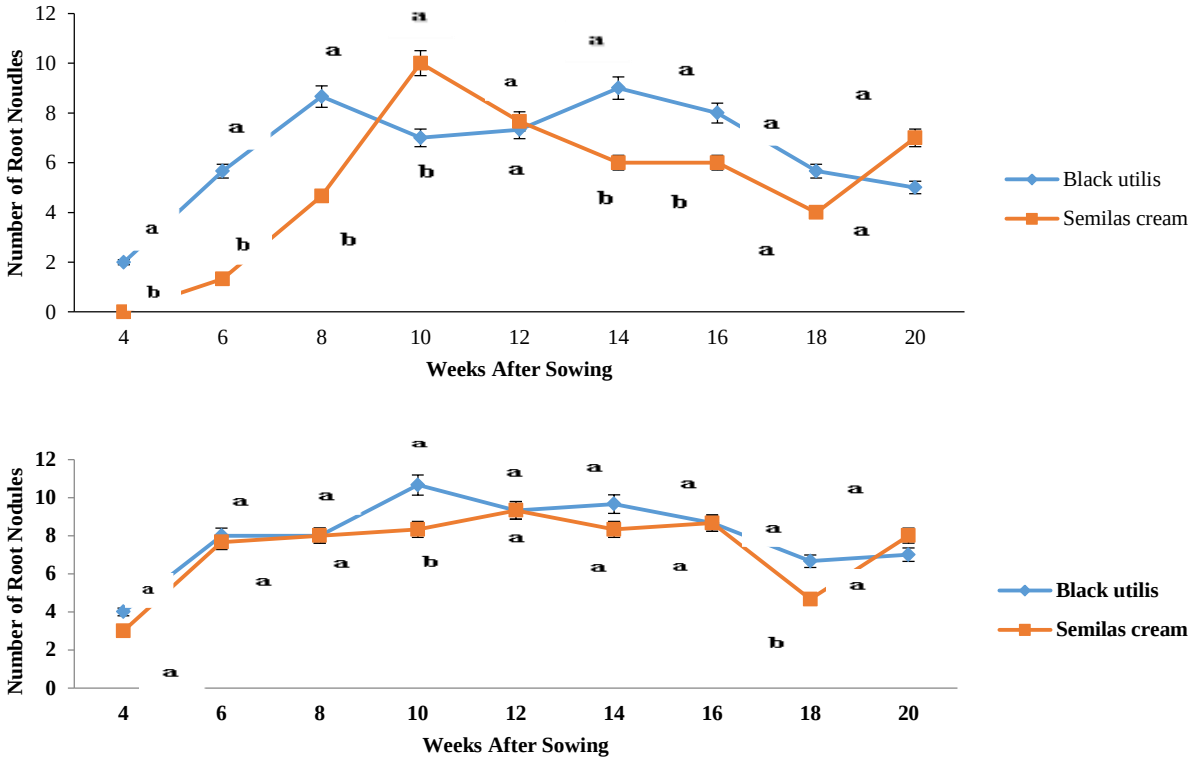
Paired vine lengths with the same letters are not significantly different at α0.05

Figure 4: Vine length of two varieties of *Mucuna pruriens* (L.) DC in Ibadan in 2019 (A) and 2020 (B)



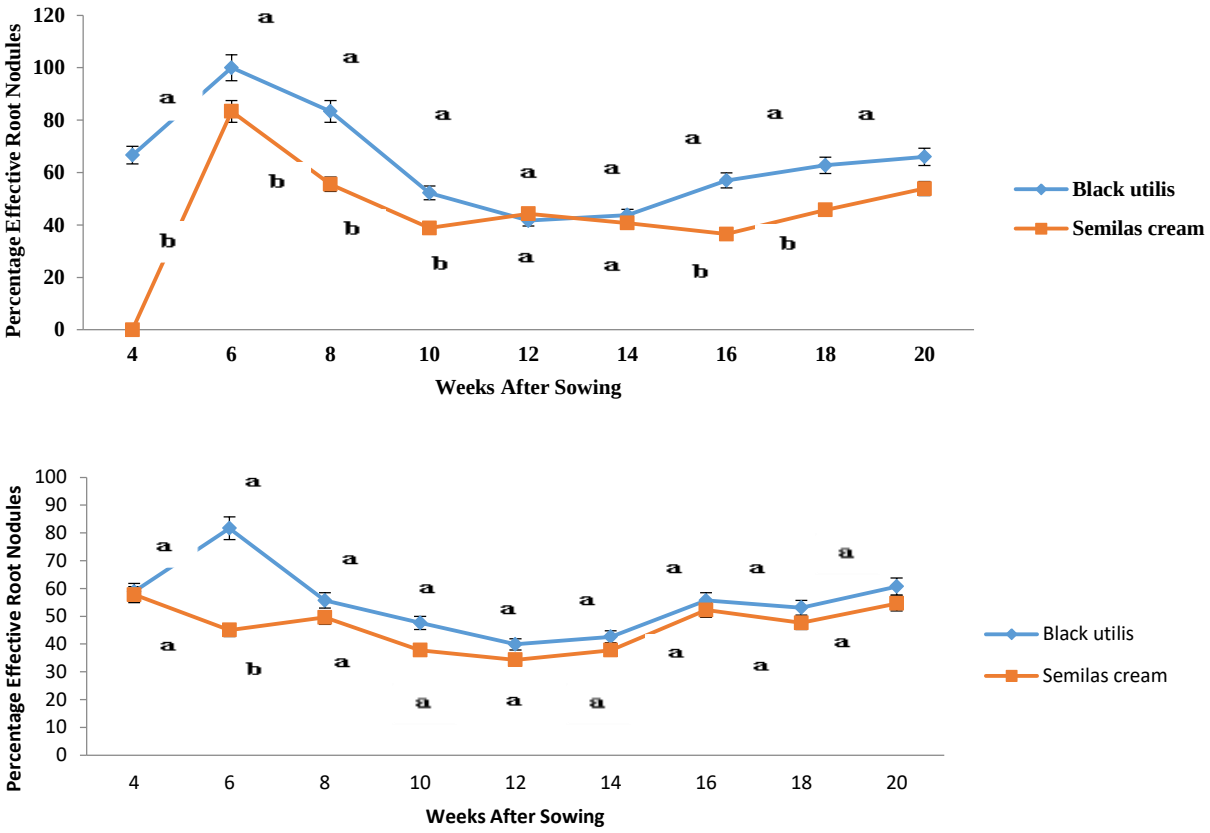
Paired numbers of tri-foliate leaves with the same letters are not significantly different at α0.05

Figure 5: Number of tri-foliate leaves of two varieties of *Mucuna pruriens* (L.) DC in Ibadan in 2019 (A) and 2020 (B)



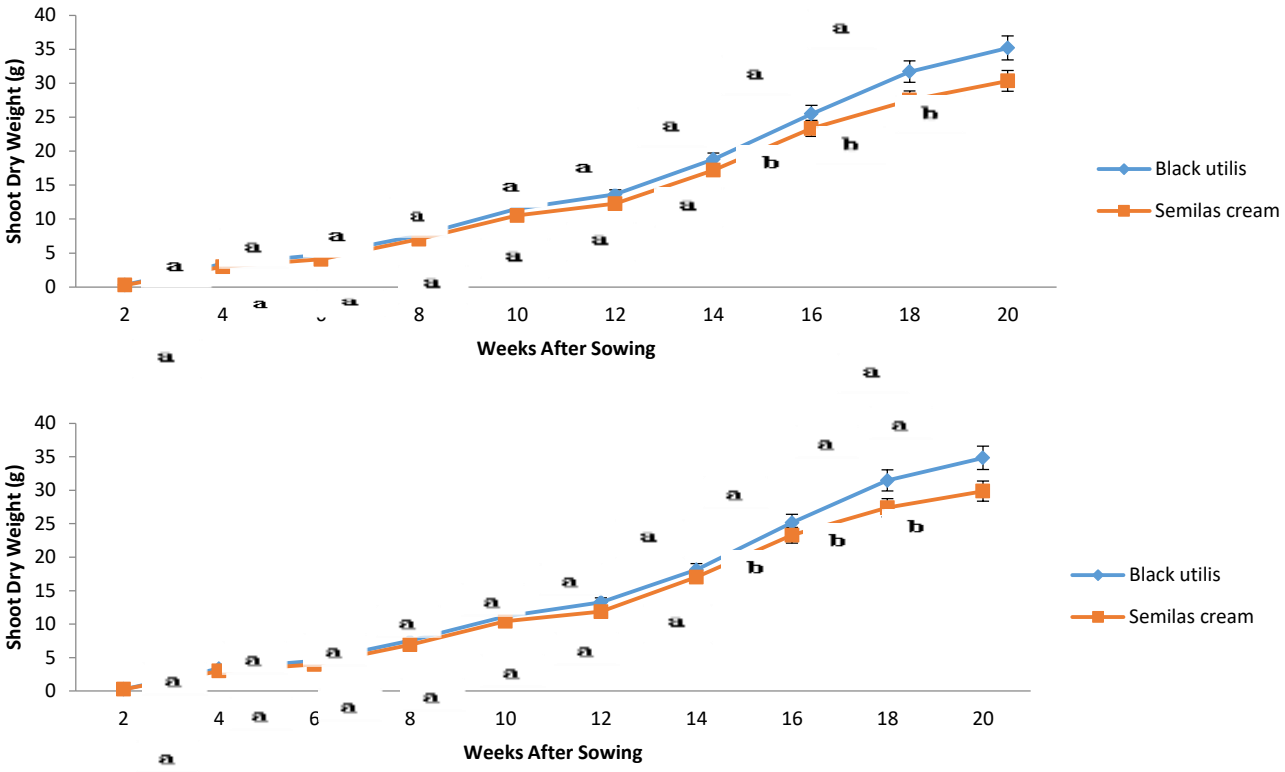
Paired numbers of root nodules with the same letters are not significantly different at α0.05

Figure 6: Number of root nodules of two varieties of *Mucuna pruriens* (L.) DC in Ibadan in 2019 (A) and 2020 (B)



Paired percentage effective root nodules with the same letters are not significantly different at α0.05

Figure 7: Percentage effective root nodules of two varieties of *Mucuna pruriens* (L.) DC in Ibadan in 2019 (A) and 2020 (B)



Paired percentage shoot dry weight with the same letters are not significantly different at α0.05

Figure 8: Shoot dry weight (g) of two varieties of *Mucuna pruriens* (L.) DC in Ibadan in 2019 (A) and 2020 (B)

DISCUSSION

The growth study showed variation in the varieties of velvet bean used. This corroborates the report of Akobodun *et al.* (2000) that velvet bean growth differs with ascensions, year and soil fertility. Nodulation of *M. pruriens* plants commenced at 4 weeks after sowing in the study. This conforms to the findings of Ibeawuchi *et al.* (2008) that nodule formation in velvet bean was observed at 4 weeks after planting. From the study, the two varieties of velvet bean had rapid growth and dry matter accumulation rate. The earlier assertion is corroborated by Baligar and Fageria (2007) who reported that velvet bean is a fast-growing plant that may cover the ground in two to three months, generating a thick 60 cm-deep mat and inhibiting the growth of weeds. The rapid growth rate exhibited by *M. pruriens* is essential in the management of weeds. This is because this feature gives aids the competitive ability of the plant with other weed species for light, water and nutrient. According to Lut *et al.* (2000), cover crops that exhibit rapid growth rate are good competitors of light, water and nutrients. The swift growth rate and canopy closure are some of the characteristics of *M. pruriens* that aids its weed suppressive ability especially under favourable conditions (Ekeleme *et al.*, 2003; Lawson *et al.*, 2006 and Kanatas *et al.*, 2020).

CONCLUSION

The study showed that *Mucuna pruriens* is a fast growing legume with significant ability to fix atmospheric. Black-utilis variety

performed better than Semilas-cream variety based on growth and yield parameters. Black-utilis can be recommended to farmers over Semilas cream variety based on its growth and biomass accumulation. The high biomass production and nitrogen fixing ability of *M. pruriens* makes it an ideal plant in the recycling of nutrients in the soil.

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