Original Research Article

Emergence and morphological response of cashew (*Anacardium occidentale* L.) treated nuts as influenced by some fungicides on young seedlings

ABSTRACT

Cashew (*Anacardium occidentale* L.) seedlings are attacked by fungi diseases such as damping off and seedling blight caused by fungi such as*Fusariumspp*. and *Rhizoctonia spp*. which can amount to about 60-65% loss in the nursery. Cashew nut seeds are majorly sown by farmers untreated.Fungicides have also been observed to delay seedling emergence and negatively influence morphological traits in some crops. This experiment aims atobserving the effect of using fungicide seed dressings on cashew seedling emergence and morphology before transplanting. Medium cashew nut biotype and three commonly used fungicides were used. The 3 months experiment was set up in the nursery using a Completely Randomized Design CRD.The treatments are; Control + Medium (Ct); Apron Star + Medium (AS), Dress Force + Medium (DF) and Seed Care + Medium (SC). Topsoil filled perforated nursery polythene bags were used. The experiment was replicated 3 times. Data were collected on the emergence and morphological traits which were analyzed using Analysis of Variance (ANOVA).No significant difference was identifiedin all morphological traits observed in the experiment among the treatments all through the duration of the experiment. From a maximum vigour scale of 5, Ct, AS and DF all had a seedling vigour of 4.7 while SC had 4.2. As a precautionary measure against fungi diseases, Apron Star, Dress Force and Seed Care have been observed not to have a negative effect on the emergence and growth of young cashew seedlings when nuts are treated with them before sowing.

Key*:Cashew; Emergence; Fungicide; Seedling; Nursery; Seed Treatment*

INTRODUCTION

Cashew (*Anacardium occidentale* L.) tree has established itself as one of the crops most suited for cultivation in regions with a variety of agroecological conditions but is majorly grown in the tropics [1]. It has been recognized as a perennial fruit crop with minimal input and great earning potential [2]. Cashew is a tree crop of major commercial value in Nigeria and other tropical countries across the world [3]. It is a sturdy drought tolerant tree crop grown for its apple and, more notably the nut in Nigeria and other cashew growing nations [4]. Commercial cashew plantations have been established in various agro-ecologies of Nigeria for cash earnings and long-term income generation [5], increasing the land area cultivated in Nigeria.

Cashew is primarily propagated by seed [6], which is commonly raised in a nursery for 2 to 3 months before transplanting to the field [7]. Seedling performance in the nursery has been observed to have a direct effect on the field establishment of the seedlings after transplanting to the field [8]. The raising of vigorous disease free cashew seedlings is very important. Therefore, to increase productivity in the nursery, effective management of the pest and disease problem is essential [2]. Fungi, which is a common pathogen of cashew responsible for most cashew seedling diseases in the nursery, must be controlled. Practices such as the use of dry, clean and insect free seeds are encouraged to enhance vigorous disease free cashew seedlings [9].

Diseases pose a significant biological limitation and seriously impair the health of cashew plants, including growth and nut yield in terms of quality and quantity [10]. Fungi are responsible for more than 10 prevalent diseases of cashew [11]. Common fungal diseases of cashew at the seedling stage include seedling blight, root rot, dieback, seedling wilt and damping-off, which together account for up to 60–65% of losses of cashew seedlings in nurseries, with damping-off the most common and responsible for 15-20% of losses [12]. *Phytophthora spp*., *Pythium spp*., *Rhizoctonia spp*., *Fusarium spp*., and *Cylindrocladium scoparium* are a few prominent fungi disease-causing pathogens [13].

Fungicide seed treatment is widely used as low-cost protection against seed and soil-borne pathogens [14]. In addition to preventing fungi diseases and pathogens, seed dressing treatments have been observed to improve plant vigor and performance [15].In Nigeria, common seed dressing fungicides with the brand names Apron Star, Apron Plus, Forte Plus, and Dress Force are frequently used in nurseries and on the field.

A large percentage of Nigerian cashew farmers do not use agrochemicals to cultivate their cashews, however, they are frequently utilized by researchers for experimental purposes [16].As a result of interactions with some cashew farmers in Nigeria, dressing cashew seeds with fungicide treatments is not a typical practice because farmers see cashew seeds as hardy seeds that don't require dressing before planting to prevent diseases. The need to investigate the use of fungicide seed treatments to prevent fungi diseases and also raise healthy seedlings is warranted by a report of Cashew seedling loss in two commercial nurseries caused by fungi diseases in the south-western area of Nigeria with a loss of approximately 80% to 85%.

However, it has been noted that seed dressing can sometimes cause a delay in germination, negatively influence early morphological features, interfere with yield in some arable crops, and could positively improve their performance [15]. Hence, it is crucial to investigate how the selected fungicide seed treatments affect the emergence of cashew seedlings and their early morphological characteristics.Therefore, the objective of this study is to observe the effect of using some selected fungicide seed treatments on cashew seedlings' emergence and early morphological traits.

MATERIAL AND METHODS

A 3-month experiment was set up in a commercial tree crop nursery at Akinyele local government area of Ibadan, Oyo State. The experiment was laid in a Completely Randomized Design (CRD) with 4 treatments including the control (Seed Care (Imidacloprid 10% + Thiram 10% WS), Dress Force (Imidacloprid 20% + Metalaxyl-M 20% + Tebuconazole 2% WS) and Apron Star (200g/kg Mefenoxam + 20g/kg Difenoconazole + 200g/kg Thiamethoxam WS) on a medium sized (4g-8g) cashew nut replicated 3 times, thus the formation are Control + Medium nuts (Ct); Apron Star + Medium nuts (AS), Dress Force + Medium nut (DF) and Seed Care + Medium nut (SC). The fungicides were applied using the recommended rate of 10g of fungicide/4kg of nuts as indicated on the label of each fungicide.

The topsoil was sieved with a 2mm sieve pan and one nut was planted in a soil filled 25cm X 12.5cm perforated nursery polythene bag. The treated cashew nuts were sown at 4cm depth and watered. Thereafter watering was done every 48 hours. Data collection on emergence percentage was recorded 2 weeks to 4 weeks after sowing. Other morphological data on plant height (cm), stem girth (mm), leaf area (cm^2) and the number of leaves were collected and recorded. Seedling vigour was measured using a scale as recommended by [17] fortnightly from 1 to 3 months after sowing (5-Excellent, 4-Good, 3-Average, 2-Below average and 1-Poor). Data collected were subjected to Analysis of Variance (ANOVA) and analyzed using SAS (2010) statistical package while means separation was done using Tukey's Standardized Range (HSD) Test at (0.05%) probability level.

RESULTS AND DISCUSSION

In a previous experiment, [15] have reported that application of fungicides as a pre-sowing treatment could delay the emergence in some crops. However, based on the emergence % result in Fig 1 at 2 weeks after sowing (WAS), cashew was found to be an exemption based on the selected fungicides used in this experiment. At 2WAS, the treated and the untreated sown cashew nuts all had a uniform emergence of 25% (Fig 1), which is an indication that the selected fungicides did not delay the emergence of cashew seedlings. This agrees with the observation of [18] that cashew seedling emergence is expected between 12 to 14 days depending on nut size. A similar result on fungicide treatments not hindering the seedling emergence was also observed in onions[19], maize [20] and field pea [21]. At 3WAS, the untreated nut which is the control treatment (Ct) had the least emergence of 58.33% followed by SC (66.67%), AS (83.33%) and DF which had 100%. This implies that Dress Force treated nuts reached maximum seedling emergence at 3WAS while Ct(58.33%) had the least. DF and AS both attained maximum emergence of 100% while SC and Ct both had 75% emergence at 4WAS, which indicates that cashew nuts treated with Dress Force and Apron Star had all seedlings emerged while both Seed Care and the control treatment had the least emergence (75%). The emergence % result from this experiment (Fig 1) does not support the findings of [15] as they reported that seed dressing with pesticides can result in delayed emergence of crop seedlings.

Fig 2 shows the cashew seedling's plant height as influenced by the 3 selected fungicides. The result showed that no comparable difference in cashew seedling plant height was observed among the treatments throughout the experiment. However, SC had the tallest plant when compared with other treatments at MTH1 (1 month after sowing) with 19.3cm seedling height, MTH2 (2 months after sowing) with 23.4cm seedling height and MTH3 (3 months after sowing) with 27.0cm seedling height. The control treatment Ct had the shortest cashew plant height at MTH1 (17.1cm) as nuts treated with fungicides (AS, DF and SC) all had faster head start than the untreated nut. However,the control treatment ranked 2nd at MTH2 (22.1cm) and MTH3 (25.6cm).

The effect of the selected fungicides on cashew seedling's number of leaves shown in Fig 3 shows that despite the variations in values of the number of leaves across all the treatments, no significant differences was observed all through the duration of the experiment. SC had the most number of leaves at MTH1 (8.3), MTH2 (12.3) and MTH3 (15.3). For the control treatment Ct, it ranked 3rd, 4th and 4th at MTH1 (7), MTH2 (9.7) and MTH3 (11.8) respectively when comparing the treatments.

Fig 4 reveals the effect of the selected fungicides on cashew seedling stem girth which can be observed that no notable difference was observed in the cashew seedling stem girth throughout the experiment. The control treatment Ct had the least stem girth in MTH1 (0.60cm), MTH2 (0.80cm) and MTH3 (0.82cm) when compared with the fungicide treated treatments in each of the months considered. SC also showed superiority once again as the result showed it had the thickest girth in MTH1 (0.70cm) though not different in value with DF and AS, MTH2 (0.88cm) and MTH (0.90cm).

As against the earlier report of the influence of SC on cashew plant height, number of leaves and stem girth ranking first in all the mentioned morphological parameters, it ranked least in leaf area in MTH1 (56.60cm^2), MTH2 (62.00cm^2) and MTH3 (73.05cm^2) though it wasn't significantly different from the other treatments as shown in Fig 5.

The morphological parameters of these cashew seedlings were not affected by Apron Star, Dress Force and Seed Care fungicides used in this experiment as Fig 6 shows that the growth of the seedlings was not altered as the treated nuts had similar seedling vigour with the control Ct all through the duration of the experiment. At MTH3, Ct, AS and DF all had similar excellent score values of 4.7 while SC also had an excellent score value of 4.5. Between good and excellent score values were recorded throughout the experiment which is an indication that the morphological parameters of the cashew seedlings were not negatively affected by the 3 different fungicides used. The result of the morphological parameters shown in Fig 2, Fig 3, Fig 4 and Fig 5 also contradicts the findings of [15]as they reported that treating seeds with fungicides before planting can adversely affect their growth and development negatively.

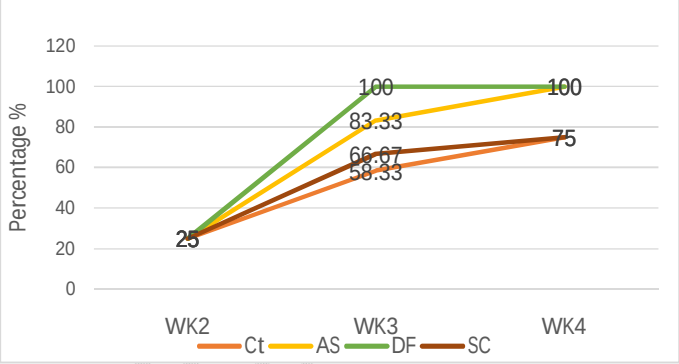

Fig. 1. Cashew seedling emergence % as influenced by 3 selected fungicides at 2, 3 and 4 weeks after sowing.

WK2 = Week 2, WK3 = Week 3, WK4 = Week 4

Ct = Control, AS = Apron Star + Medium, DF = Dress Force + Medium, SC = Seed Care + Medium

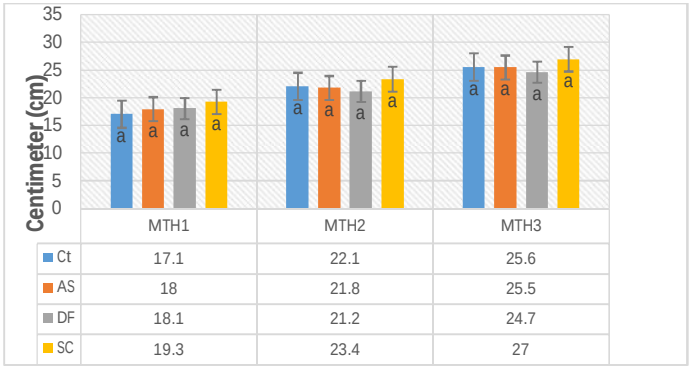

Fig. 2. Cashew seedling plant height as influenced by 3 selected fungicides at 1, 2 and 3 months after sowing.

MTH1 = Month 1, MTH2 = Month 2, MTH 3 = Month 3.

Ct = Control, AS = Apron Star + Medium, DF = Dress Force + Medium, SC = Seed Care + Medium

Bars marked with different letters show means are significantly different at 0.05 level of probability.

Vertical bars show standard error.

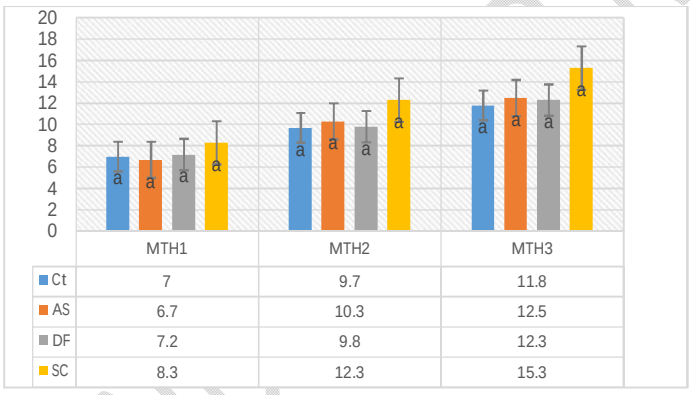

Fig. 3. Cashew seedling number of leaves as influenced by 3 selected fungicides at 1, 2 and 3 months after sowing.

MTH1 = Month 1, MTH2 = Month 2, MTH 3 = Month 3.

Ct = Control, AS = Apron Star + Medium, DF = Dress Force + Medium, SC = Seed Care + Medium

Bars marked with different letters show means are significantly different at 0.05 level of probability.

Vertical bars show standard error.

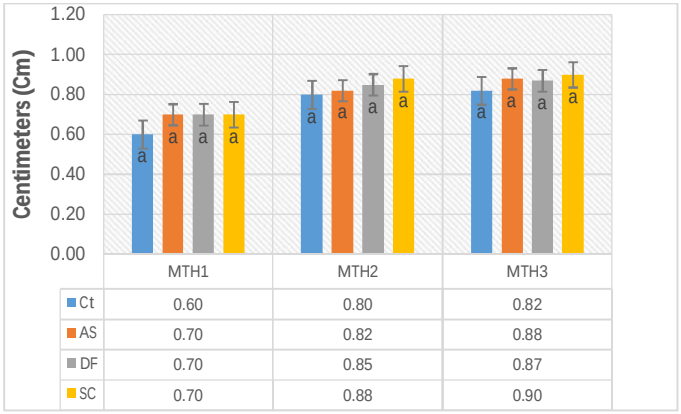

Fig. 4. Cashew seedling stem girth as influenced by 3 selected fungicides at 1, 2 and 3 months after sowing.

MTH1 = Month 1, MTH2 = Month 2, MTH 3 = Month 3.

Ct = Control, AS = Apron Star + Medium, DF = Dress Force + Medium, SC = Seed Care + Medium

Bars marked with different letters show means are significantly different at 0.05 level of probability.

Vertical bars show standard error.

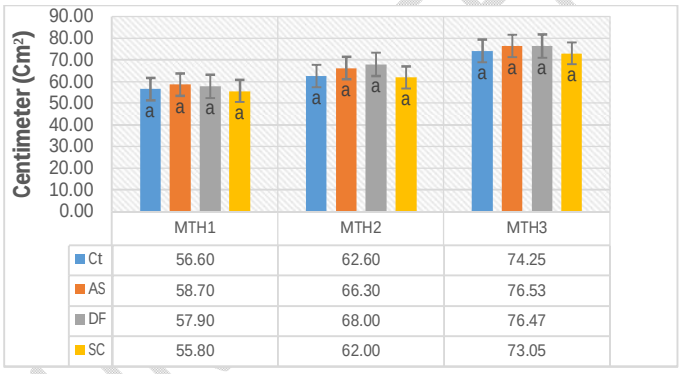

Fig. 5. Cashew seedling leaf area (cm^2) as influenced by 3 selected fungicides at 1, 2 and 3 months after sowing.

MTH1 = Month 1, MTH2 = Month 2, MTH 3 = Month 3.

Ct = Control, AS = Apron Star + Medium, DF = Dress Force + Medium, SC = Seed Care + Medium

Bars marked with different letters show means are significantly different at 0.05 level of probability.

Vertical bars show standard error.

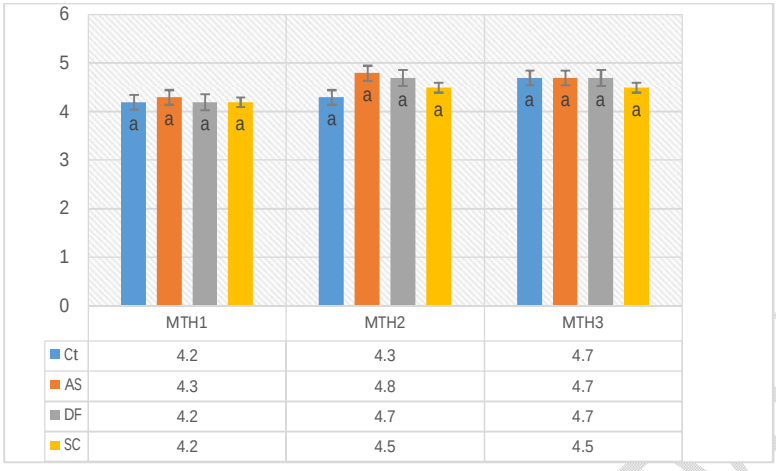

Figure 6: Figure 6: Cashew seedling vigour as influenced by 3 selected fungicides at 1, 2 and 3 months after sowing.

MTH1 = Month 1, MTH2 = Month 2, MTH 3 = Month 3.

Ct = Control, AS = Apron Star + Medium, DF = Dress Force + Medium, SC = Seed Care + Medium

Bars marked with different letters show means are significantly different at 0.05 level of probability.

Vertical bars show standard error.

CONCLUSION

The ~~3~~ three selected fungicides (Apron Star, Dress Force and Seed Care) used as pre-sowing treatment against fungi diseases did not encourage delay inthe emergence of the young cashew seedlings ~~,and~~ in addition, Apron Star and Dress Force fungicides showed the tendency to improve the emergence. The fungicides also showed tendencies to improve the growth and development of the cashew seedlings rather than imposing a detrimental effect on the young cashew seedling growth. As a preventive measure against fungus~~fungi~~ diseases, Apron Star, Dress Force and Seed Care have been identified not to have a negative impact ~~on~~ on the cashew seedling emergence and growth when treated with them. However, a repeat of this experiment is encouraged to validate the effect of the selected fungicides on cashew seedlings. Furthermore, the potential of the selected fungicides should be observed to check if they can prevent fungi diseases in young cashew seedlings.

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COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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