



Assessment of Morphological Traits and Their Correlation in Spinach (*Spinacia oleracea* L.) Under Varying Application Rate of Dress Force

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Abstract

Spinach (*Spinacia oleracea* L.) production is constrained by poor seedling establishment and diseases caused by seed- and soil-borne pathogens. This study evaluated the effects of different rates of Dress Force seed dressing on spinach growth, disease incidence, and maturity under Sudan Savanna conditions of northwestern Nigeria. Four treatment rates (0, 1, 2, and 4 g per 50 g seed) were arranged in a Randomized Complete Block Design with three replications. Results showed that Dress Force significantly enhanced plant density, leaf number, plant height, and leaf length while reducing disease incidence and promoting earlier maturity compared with the untreated control. The 2 g Dress Force per 50 g seed treatment consistently produced the best overall performance, whereas higher rates offered no significant additional benefits. Therefore, 2 g per 50 g seed is recommended for optimum spinach production. The results indicate that greater plant vigour was associated with higher dry matter accumulation, while increased leaf number was associated with reduced plant vigour and dry matter production.

Keywords: Spinach, Dress Force, seed treatment, growth performance, Sudan Savanna.

Introduction

Spinach (*Spinacia oleracea* L.) is a nutritious leafy vegetable valued for its high content of vitamins, minerals, antioxidants, and dietary fiber, contributing significantly to human nutrition and farmers' income (Morelock and Correll, 2008; Yadav et al., 2013). However, its production is constrained by poor seed germination and diseases caused by seed- and soil-borne pathogens, which reduce crop establishment and yield. Seed treatment with fungicides is an important management practice that protects seedlings, improves germination, enhances plant vigor, and increases productivity (Taylor et al., 2010; Katzman et al., 2001). However, excessive application may result in phytotoxicity and increased production costs. Therefore, this study was conducted to determine the optimum Dress Force seed dressing rate for improving spinach growth and disease resistance under Sudan Savanna conditions of northwestern Nigeria.

Materials and Methods

The experiment was conducted during the 2024/2025 rainy season at the Teaching and Research Farm of Kebbi State University of Science and Technology, Aliero, located in the Sudan Savanna zone of northwestern Nigeria (13°08' N, 5°15' E). Spinach (*Spinacia oleracea* L.) variety CH4 was obtained from the National Horticultural Research Institute (NIHORT), Ibadan, while Dress Force seed dressing chemical was sourced from a registered agrochemical dealer. Four seed treatment rates (0, 1, 2, and 4 g Dress Force per 50 g seed) were evaluated using a Randomized Complete Block Design (RCBD) with three replications. Treated seeds were sown by the drilling method in 3 m × 2 m plots. Data collected were subjected to analysis of variance (ANOVA), and treatment means were separated using Duncan's Multiple Range Test (DMRT) at the 5% level of significance.

Results and Discussion

Summarized Results and Discussion:

Seed treatment with Dress Force significantly improved leaf production in spinach, with leaf number increasing as the application rate increased up to 2 g per 50 g of seed. The highest leaf production was recorded at 2 g, while the untreated control produced the fewest leaves. This improvement is likely due to enhanced seed health, reduced pathogen attack, and better nutrient utilization, which promoted vigorous vegetative growth. Increasing the rate to 4 g did not provide additional benefits, indicating that 2 g per 50 g seed was the optimum treatment rate. These findings are consistent with Taylor et al. (2010), who reported that seed enhancement treatments improve seedling vigor and vegetative growth by protecting seedlings from disease during establishment.

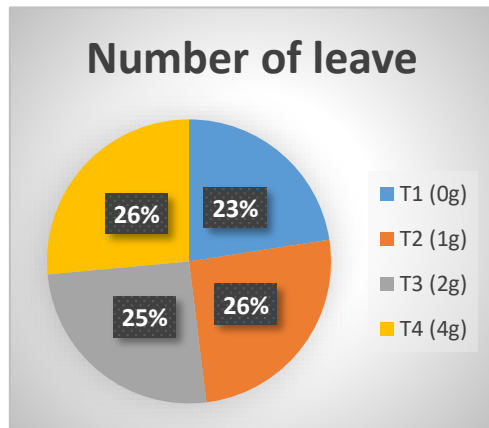


Fig.1: Effect of Various Application Rate of Dress Force on Number of Leaves

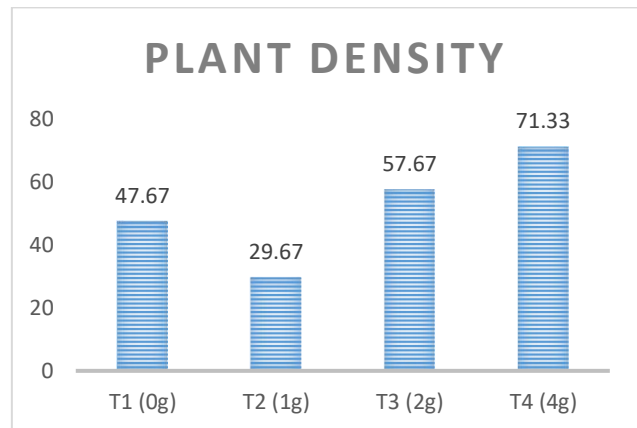


Fig.2: Effect of Various Application Rate of Dress Force on Plant Density

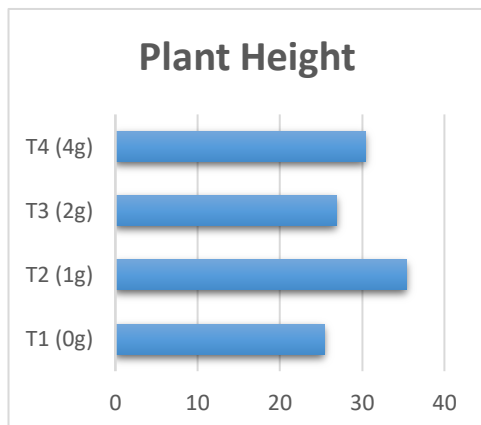


Fig.3: Effect of Various Application Rate of Dress Force on Plant Height

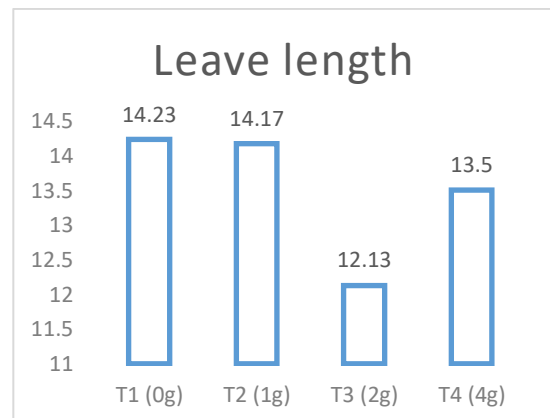


Fig.4: Effect of Various Application Rate of Dress Force on Leave Length

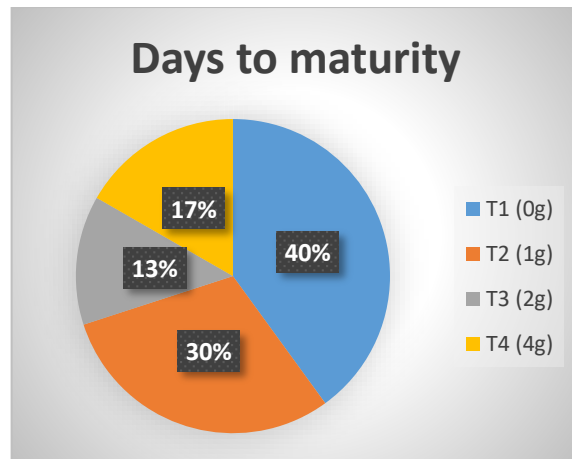
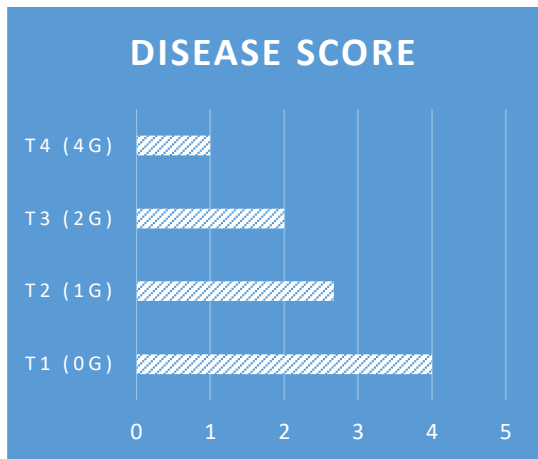


Fig. 5: Effect of Various Application Rate of Dress Force on Diseases **Fig. 6:** Effect of Various Application Rate of Dress Force on Days to Maturity

Table-1: Pearson Correlation Matrix among Disease, Growth and Yield Parameters

Variable	PV	PH	LN	DSS	LL	DM	SD
PV							
PH	-0.16						
LN	-0.97*	0.34					
DSS	0.88	-0.61	-0.94				
LL	0.56	0.19	-0.67	0.56			
DM	0.93*	-0.16	-0.97*	0.88	0.54		
SD	-0.19	-0.53	0.39	-0.10	0.54	-0.19	

*Note: Correlation is significant at $P \leq 0.05$ (two-tailed; $n = 4$). No correlation is significant at $P \leq 0.01$.

PV = Plant vigor, PH = Plant height (cm), LN = Number of leaves, DSS = Disease severity score, LL = Leaf length (cm), DM = Days to maturity, SD = Stem diameter

Figure 1. Effect of various application rates of Dress Force on number of leaves of spinach. Effect of Different Rates of Dress Force on Plant Density. Plant density was influenced by seed treatment levels as shown in Figure 2. Treated seeds generally produced higher plant populations compared with untreated seeds. Maximum plant density was obtained from seeds treated with 2 g Dress Force, while the control treatment produced the lowest stand establishment. Improved plant density indicates enhanced seed germination and successful emergence. The fungicidal properties of Dress Force likely protected the seeds from soil-borne fungal pathogens responsible for damping-off and seed decay. This observation agrees with Katzman et al. (2001), who reported that seed treatment improves germination percentage and seedling establishment in spinach.

Figure 2. Effect of various application rates of Dress Force on plant density of spinach. Effect of Different Rates of Dress Force on Plant Height. Plant height response to Dress Force application is illustrated in Figure 3. Although differences among treatments were relatively small, treated plants generally exhibited greater height compared with untreated plants. The highest plant height was recorded in plants treated with 2 g Dress Force. Similar observations were reported by Wilcox and Pfeiffer (2010), who demonstrated that favorable seed treatments improve early plant growth without necessarily requiring excessive chemical inputs.

Figure 3. Effect of various application rates of Dress Force on plant height of spinach. Effect of Different Rates of Dress Force on Leaf Length. Leaf length is a major determinant of marketable yield in leafy vegetables. Results presented in Figure 4 indicate that Dress Force significantly enhanced leaf elongation. Plants treated with 2 g Dress Force produced the longest leaves, The present findings support the reports of Morelock and Correll (2008), who indicated that healthy spinach plants develop larger leaves with greater photosynthetic efficiency and market value.

Figure 4. The untreated control recorded the highest disease severity, while treated plants exhibited considerably lower disease levels. Treatments receiving 2 g and 4 g Dress Force produced the lowest disease scores. These findings corroborate the reports of Suganuma and Ohno (2010), who stated that fungicidal seed treatments effectively reduce

fungal infections in spinach. Similarly, Fontem et al. (2008) observed that disease management through fungicide application significantly reduced disease severity and improved vegetable crop productivity.

Figure 5. Effect of various application rates of Dress Force on disease incidence of spinach. Effect of Different Rates of Dress Force on Days to Maturity. The influence of Dress Force on days to maturity is presented in Figure 6. Treated plants generally reached maturity earlier than untreated plants. The shortest maturity period was recorded in the 2 g and 4 g Dress Force treatments. Similar observations have been reported by Atherton and Farooque (1983), who noted that improved germination and establishment contribute significantly to accelerated crop development.

Figure 6. The results showed that seed treatment with Dress Force significantly influenced the maturity period of the crop. The untreated control (0 g Dress Force per 50 g seed) recorded the longest period to maturity, indicating slower crop development. In contrast, seeds treated with Dress The present result is consistent with the findings of Taylor et al. (2010), who reported that seed enhancement treatments improve seedling establishment and crop growth, leading to more uniform and earlier crop development. Similarly, Atherton and Farooque (1983) observed that favorable germination and early growth conditions contribute significantly to accelerated plant development and reduced time to maturity.

The Pearson correlation analysis revealed significant relationships among some of the measured traits (table 1). Plant vigour (PV) was significantly and negatively correlated with leaf number (LN) ($r = -0.979^*$), but significantly and positively correlated with dry matter (DM) ($r = 0.930^*$). Similarly, leaf number showed a significant negative correlation with dry matter ($r = -0.979^*$). Although disease severity score, plant height, leaf length, and seed diameter exhibited positive or negative associations with several traits, these relationships were not statistically significant.

Conclusion

Application of Dress Force enhanced plant establishment, increased leaf production, improved plant height and leaf length, reduced disease incidence, and promoted earlier maturity compared with untreated seeds. Among the application rates evaluated, 2 g Dress Force per 50 g seed consistently produced the best overall performance across most growth and disease-related parameters. Although the 4 g treatment also resulted in favorable growth and disease suppression, it did not provide significant advantages over the 2 g rate. Therefore, the application of 2 g Dress Force per 50 g seed is considered the optimum rate for achieving healthy crop growth, effective disease management, and efficient spinach production. The findings highlight the importance of seed treatment as a cost-effective agronomic practice for improving spinach productivity and profitability in the Sudan Savanna agro-ecological zone and similar environments. The results indicate that greater plant vigour was associated with higher dry matter accumulation, while increased leaf number was associated with reduced plant vigour and dry matter production.

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