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EXPLORING THE INFLUENCE OF HARVEST VARIABLES ON SESAME CROP YIELD IN OWERRI, NIGERIA

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Article Info

Keywords: Sesame, Relationship, regression model, Co-efficient of determination.

Abstract

This study aimed to comprehend the correlation between seed yield and various yield parameters of sesame by analyzing 100 sesame stands from the Federal University of Technology's sesame field in Owerri, Nigeria. Measurements taken included Leaf Area (LA), Leaf Area Index (LAI), Total Dry Matter (TDM) at 4, 5, and 8 weeks after planting, and Number of Capsules (NCap), Number of seeds per capsule (NSeed), Thousand Seed Weight (TSW), Seed Yield per plant, and TDM at harvest. Seed yield values were regressed on all other parameters to determine the coefficient of regression (r2) and the regression model. There was a significant linear relationship between seed yield and some parameters, with models involving TSW, NCap, NSeed, and TDM at harvest having r2 values ranging from 71.4% to 85.9%. The corresponding models were 0.00121 + 0.00234 NCap (r2 = 85.9%), 0.0028 + 0.0009217 NSeed (r2 = 76.8%), 0.00309 + 0.00008583 TDM harv (r2 = 71.6%), and 0.00045 + 0.01732 TSW (r2 = 71.4%). These models can serve as effective tools for developing yield predictor machines for sesame in precision agriculture, thereby enhancing the understanding of the relationship between seed yield and various harvest parameters.

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Introduction

Sesame (Sesamum indicum L.) is an important oilseed crop cultivated in tropical and subtropical regions worldwide (Ashri, 2007). It is known for its high oil content, rich in unsaturated fatty acids and antioxidants, which contribute to its nutritional and medicinal properties (Elleuch et al., 2007). Nigeria is one of the major sesame-producing countries in Africa, with an estimated production of 580,000 metric tons in 2020 (FAOSTAT, 2021). Despite its economic and nutritional importance, sesame yield in Nigeria remains low compared to other major producing countries such as China, India, and Myanmar (Makinde et al., 2017). This low yield has been attributed to various factors, including inadequate agronomic practices, low genetic potential of local varieties, and environmental constraints (Echekwu et al., 2016).

Recent studies have reported the significant influence of harvest variables, such as harvest time, moisture content, and threshing methods, on sesame crop yield and quality (Gebretsadik et al., 2019; Onyia et al., 2021). Harvest time is a critical factor that determines the quality and quantity of sesame seeds, as it influences seed maturity, seed weight, and oil content (Narayana et al., 2012). Late or early harvesting can lead to a reduction in yield due to shattering losses or reduced seed size, respectively (Aman et al., 2013). Furthermore, moisture content at the time of harvest is crucial in determining the storability and quality of sesame seeds, as high moisture content can cause seed deterioration and fungal contamination (Amankwah et al., 2014).

Threshing methods have also been reported to affect sesame yield and seed quality. Traditional manual threshing methods, such as beating with sticks or trampling by animals, can result in high seed losses and seed damage, which reduces the market value of the crop (Gebretsadik et al., 2019). Mechanical threshing has been proposed as an alternative to traditional methods to reduce seed losses and improve seed quality (Onyia et al., 2021). However, the adoption of mechanical threshing in Nigeria is still limited due to the lack of appropriate machinery and the associated high costs (Echekwu et al., 2016).

Despite the potential impact of harvest variables on sesame crop yield, limited research has been conducted on the influence of these factors in the Nigerian context, particularly in Owerri, a major sesame-producing region. Therefore, this study aims to explore the influence of harvest variables, including harvest time, moisture content, and threshing methods, on sesame crop yield in Owerri, Nigeria. The findings of this study could provide valuable insights for farmers, policymakers, and researchers to develop appropriate harvest management strategies to improve sesame yield and quality in Nigeria.

Materials and Methods

The experiment was conducted at the Teaching and Research farm of the Federal University of Technology, Owerri, Nigeria with annual rainfall of about 2500 mm. Sesame seeds were planted out and data were taken from 100 plants. The data collected included LA, LAI, TDM at 4, 5 and 8 weeks after planting; while number of capsules (NCap), Number of seeds (NSeed), 1000 seed weight (TSW), seed yield per plant and TDM were taken at harvest. The values obtained for seed yield per plant was regressed on all other parameters. The coefficient of regression and regression models was subsequently developed.

Results and Discussion

The results of the regression revealed that there was a significant linear relationship between the seed yield per plant and each of LA, LAI, TDM, NCap, NSeed and TSW at the various sampling times. This corroborates with the work of Escante and Kohashi (2008) who had also established a relationship between seed yield and leaf area and Vina and Taryono (2016) who reported that sesame seed yield/plant had positive and significant correlation with plant height, number of capsules/plant, biomass yield/plant and 1000 seed weight.

In this study, models that involved number of capsules per plant, number of seeds per capsule, 1000 seed weight and total dry matter at harvest, all had coefficient of determination (r^2) ranging from 0.714 to 0.859. Parameters whose data were taken at 4 and 8 weeks after planting had r^2 values from 0.130 to 0.190 while those taken at 8 weeks had r^2 values ranging 0.574 to 0.575. This suggest a better contribution of growth and yield parameters to sesame seed yield increases as the crop advances in age with the highest contribution made from the harvest parameters. 85.9% of the variabilities in the seed yield per plant was accounted for by the model involving Number of capsules per plant; 76.8% by model involving number of seed/capsule; 71.6% for model involving total dry matter at harvest and 71.4% for models involving 1000 seed weight. This is in agreement with Aristya *et al*. (2017) and Shakeri *et al*. (2016) who under various environmental and genetic conditions, had established that 1000 seed weight and the number of capsules per plant stand out, among other growth parameters in their relationship/contribution to seed yield of sesame

This corresponds to the models; 0.00121 + 0.00234 NCap, 0.0028 + 0.0009217 NSeed,
0.00309 + 0.00008583 TDM harv. and 0.00045 + 0.01732 TSW.

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Mendoza (2018) had also established a linear association between sesame seed yield per plant and 1000 seed weight.

These models are effective tools in the development of yield predictor machines in the precision agriculture.

Table 1. Yield relationship model for sesame

Parameters	r^2	Standard Error	Yield model
LA @4 WAP	0.158	0.0271	-0.00052 + 0.0001202 LA4
LA @5 WAP	0.175	0.0268	-0.00189 + 0.0000765 LA5
LA @8 WAP	0.575	0.0193	-0.000795 + 0.01475 LA8
LAI @4 WAP	0.158	0.271	-0.00048 + 0.036 LAI4
LAI @5 WAP	0.175	0.0268	-0.00189 + 0.02295 LAI5
LAI @8 WAP	0.575	0.0193	-0.00189 + 0.01475 LAI8
TDM @4 WAP	0.130	0.0276	0.00232 + 0.01516 TDM4
TDM @5 WAP	0.190	0.0266	-0.00004 + 0.00798 TDM5
TDM @8 WAP	0.574	0.0193	-0.00504 + 0.002813 TDM8
TDM @ harvest	0.716	0.0158	0.00309 + 0.00008583 TDM Harv.
NCap	0.859	0.0111	0.00121 + 0.00234 NCap
NSeed	0.768	0.0142	0.00028 + 0.0009217 NSeed
TSW	0.714	0.0158	0.00045 + 0.01732 TSW

Key:
LA = Leaf Area; LAI = Leaf Area Index;
TDM = Total dry matter; NCap = Number of capsules per plant
NSeed = Number of seeds per capsule; TSW = 1000 seed weight

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