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YIELD AND ECONOMICS OF NIGER (*GUIZOTIAABYSSINICA* L.F. CASS) AS INFLUENCED BY DIFFERENT SPACINGS AND VARIETIES

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ABSTRACT

A field experiment was conducted during *Kharif* 2024 at the Experimental Farm of Agronomy Section, College of Agriculture, Latur to study the effect of spacings and varieties on the yield and economics of Niger (*Guizotiaabyssinica* L.). The soil was clayey in texture, moderately alkaline, low in available phosphorus, moderate in nitrogen and high in potassium. The experiment was laid out in a Split Plot Design with three varieties PNS-6, PhuleKarala, and PhuleVaitarna as main plot and three spacings 45 cm × 20 cm, 45 cm × 10 cm, and 45 cm × 15 cmas sub main plots. Result revealed that niger variety PNS-6 recorded significantly highest yield attributes *viz*. number of seeds per capsule (43.44), seed yield per plant (2.63 g), test weight (4.54 g), seed yield (566 kg ha^{-1}), biological yield (6127 kg ha^{-1}), gross monetary return (84940 Rs. ha^{-1}) and net monetary return (47490 Rs. ha^{-1}) which was at par with PhuleKarala and found significantly superior over Phule Vaitarana. Wider spacing of 45 cm × 20 cm recorded significantly highest yield attributing characters *viz*. seed yield per plant (2.71 g) which was at par with 45 cm × 15 cm and found significantly superior over 45 cm × 10 cm. Whereas closer spacing 45 cm × 10 cm resulted highest seed yield (490 Kg ha^{-1}), biological yield (6246 Kg ha^{-1}), gross monetary return (73545 Kg ha^{-1}) and net monetary return (36052 Kg ha^{-1}) which was at par with 45 cm × 15 cm and found significantly superior over wider spacing of 45 cm × 20 cm.

***Key words*:** Niger, Spacings, Varieties, Yield, Economics

Introduction

Niger (*Guizotiaabyssinica* L.), a member of the Compositae family, is an important oilseed crop grown primarily in India, Ethiopia, East Africa, the West Indies, and Zimbabwe. Among these, India and Ethiopia are the leading producers globally. Key Niger-producing states include Madhya Pradesh, Bihar, Maharashtra, Odisha, Karnataka, and Tamil Nadu. Despite being considered a minor oilseed globally, it holds significant value in rainfed and tribal farming systems, particularly on marginal lands and hill slopes. The crop is highly adaptable, resistant to pests and diseases, and contributes to soil conservation and land restoration. Its seeds contain 40% oil, rich in linoleic and oleic acids, and the oil is valued for its edible and medicinal uses. Niger thrives under low-input conditions but suffers from low productivity due to traditional farming practices and poor soil fertility. Enhancing yield, it requires the development of high-yielding varieties and optimized agronomic practices like appropriate plant spacing. Understanding genetic diversity and crop-environment interactions is crucial to improve its productivity under diverse agro-climatic conditions. This study explores varietal and spacing effects to maximize yield in Niger under rainfed conditions.

Material and Method

The field investigation was conducted during *kharif* 2024 at Experimental Farm, Department of Agronomy, College of Agriculture, Latur to study the effect of spacings and varieties onyield and economics of Niger (*Guizotiaabyssinica* L.) during *Kharif* Season. The soil was clayey in texture, moderately alkaline (pH 7.58), low in available phosphorus (7.46 kg ha^{-1}), moderate in nitrogen (137.98 kg ha^{-1}) and high in potassium (1045.60 kg ha^{-1}). The experiment was laid out in a Split Plot

Table 1: Yield attributes of Niger influenced by various treatment.

Treatment	NSC	SYP	TW	SY	BY
Main: Varieties (V)					
V_1- PNS-6	43.44	2.63	4.54	566	6127
V_2- Phule karala	40.33	2.59	4.36	481	5925
V_3- Phule vaitran	36.11	2.11	3.19	316	5545
SE ±	0.87	0.10	0.18	33	83
CD	3.42	0.40	0.72	128	326
Sub main: Spacings (S)					
S_1- 45 cm ×20 cm	41.33	2.71	4.03	366	5448
S_2- 45 cm ×10 cm	38.66	2.00	4.02	520	6246
S_3- 45 cm ×15 cm	38.88	2.61	4.05	477	5903
SE ±	0.96	0.07	0.108	17	148
CD	NS	0.22	NS	51	457
Interaction (V × S)					
SE ±	1.66	0.13	0.19	29	356
CD	NS	NS	NS	NS	NS

NSC: No of seeds cpsule^{-1}; SYP: Seed yield plant^{-1} (g); TW: Test weight (g); SY: Seed yield (kg ha^{-1}); BY: Biological yield (kg ha^{-1})

Design. The main plot consists of three varieties V_1-PNS-6, V_2- PhuleKarala, and V_3-Phule Vaitarna and sub plot consist of three spacings S_1-45 cm × 20 cm, S_2-45 cm × 10 cm, and S_3- 45 cm × 15 cm, were replicated thrice. Sowing of all the Niger varieties was done as per treatments by dibbling. The gross plot size was 5.4 m × 4.6 m and net plot size were as per treatments. The recommended cultural practices and plant protection measures were taken. The data collected from various observations were organized into tables and analyzed using analysis of variance (ANOVA). The significance of treatment was tested by F test (Panse & Sukhatme, (1967).

Methodology

Number of Seeds Capsule^{-1}

The total number of seeds per capsule was recorded by counting from five randomly selected plants from each net plot at the time of harvest.

Seed Yield plant^{-1} (g)

Seeds from the same five tagged plants were cleaned and dried after harvest. The seed yield per plant was then measured in grams (g).

Test Weight (g)

A test weight was determined by counting 1,000 seeds at random from the net plot's produce and recording the weight in grams.

Seed Yield (kg ha^{-1})

Each net plot's plants were gathered and threshed out. Following threshing, the seeds were cleaned using a winnow, and the weight of each seed per net plot was noted. This was then multiplied by the hector factor to get (kg ha^{-1}).

Table 2: Gross and net monetary returns (Rs. ha^{-1}) and B: C ratio of Niger as influenced by different treatments.

Treatment	GMR	NMR	BCR
Variety (V)			
V_1- PNS-6	84940	47490	2.26
V_2 – Phule karala	63185	25755	1.66
V_3 – Phule Vaitarana	47325	9941	1.27
SE ±	4887	4900	0.129
CD	19189.3	19241	0.507
Spacing (S)			
S_1 – 45 cm × 20 cm	54744	17474	1.46
S_2 – 45 cm × 10 cm	73545	36052	1.95
S_3 – 45 cm × 15 cm	67161	29660	1.78
SE ±	2468.3	2481.1	-
CD	7605	7645.1	-
Interaction			
SE ±	4275.1	4297.4	-
CD	NS	NS	-
GM	65150	27729.1	1.73

GMR: Gross monetary return(Rs. ha^{-1}); NMR: Net monetary return (Rs. ha^{-1}); BCR: Benefit cost ratio (B:C)

Biological Yield (kg ha^{-1})

The biological yield was calculated using the following formula:

Biological yield = Seed yield + Straw yield

Harvest Index (%)

The Harvest Index (HI) represents the plant's efficiency in converting photosynthates into economic yield. It was calculated using the formula:

$$\text{Harvest Index} = \frac{\text{Grain Yield}}{\text{Biological Yield}} \times 100\%$$

Where:

Biological yield = Seed yield + Straw yield

Gross monetary returns (Rs. ha^{-1})

The gross monetary returns occurred due to different treatments in the present study, were worked out by considering the market prices of seed yield of Niger during the experimental year.

Cost of cultivation (Rs. ha^{-1})

The cost of cultivation of each treatment was worked out by considering the prices of variable inputs *viz.*, labour, fertilizer, seed, bullock charges, machinery charges and plant protection.

Net monetary returns (Rs. ha^{-1})

The net monetary returns of each treatment were worked out by deducting the cost of cultivation of each

treatment from the gross monetary returns gained from the respective treatments.

Benefit: Cost ratio

The benefit: cost ratio of each treatment was calculated by dividing the cost of cultivation to gross monetary.

Statistical analysis and interpretation of data

Data obtained on various variables were analyzed by "Analysis of variance method" (Panse and Sukhatme, 1967). The total variance (S^2) and degree of freedom (n-1) were partitioned into different possible sources. The variance of treatments and replications were calculated and compared with error variance for finding out 'F' value and ultimately for testing the significance at P=0.05. Wherever, the results were found significant, critical differences were calculated for comparison of treatment mean at 5 % level of significance.

Results and Discussion

Yield attributes

Effect of variety

Varietal differences significantly influenced yield components and yield in Niger. The variety PNS-6 (V_1) recorded the highest number of seeds per capsule (43.44), higher seed yield per plant (2.63 g) and test weight (4.54 g), seed yield (566 kg ha^{-1}) and biological yield (6127 kg ha^{-1}) which was comparable with Phule Karala (V_2) and found significantly superior to PhuleVaitarana (V_3).The superior yield performance of PNS-6 was due to its higher number of capsules, seeds per capsule, and test weight. These results underline the superior performance of PNS-6 in terms of both seed and biomass yield and are supported by several earlier studies. Malode (2003), Kadam (2007), Dhange (2007), Kumar *et al*., (2011), Ukale (2014) and Shaikh *et al*., (2019).

Effect of spacings

The number of seed $capsule^{-1}$ and test weight (g) of Niger were to differed significantly due to various spacing. The wider spacing 45 cm × 20 cm (S_1) recorded higher seed yield $plant^{-1}$ (2.71 g) of Niger which was at par with 45 cm × 15 cm (S_3) and found significantly superior over 45 cm × 10 cm (S_2). The closer spacing of 45 cm × 10 cm (S_2) recorded significantly higher seed yield (520 kg/ha) and biological yield (6246 kg/ha) of Niger which was at par with 45 cm × 15 cm (S_3) and found significantly superior over 45 cm × 20 cm (S_1). It might be due to increased plant density and dry matter accumulation per unit area at closer spacing. These results affirm that closer spacing enhances yield per area, while wider spacing benefits individual plant performance. Similar results were reported by Kasle *et al*., (2017), Uke *et al*., (2009) and Kathmale *et al*., (2008), Sandeep and Kusbad (2020) and Nadeem *et al*., (2015).

Economics

Effect of variety

Gross Monetary Returns and Net Monetary Returns of nigerwere influenced significantly due to different variety. The variety PNS-6 recorded highest gross monetary returns and net monetary returns (84940 Rs. ha^{-1} and 47490 Rs. ha^{-1}) and found to be significantly superior over Phulekarala and Phulevaitarana. Highest B:C ratio was also observed with variety PNS-6 (2.26). Similar finding was reported by Kumar and Kubsad (2014) and Shaikh *et al*., (2019).

Effect of spacing

The highest GMR and NMR (73545 Rs. ha^{-1} and 36052 Rs. ha^{-1}) received with spacing of 45 x 10 cm which was at par with the 45 × 15 cm and found significantly superior over 45 × 20 cm (54744 Rs. ha^{-1} and 17474 Rs. ha^{-1}). Similar results were observed by Kivadasannavar *et al*., (2007), Sandeep and Kusbad (2017), Nadeem *et al*., (2015) and Kasle *et al*., (2020).

Interaction effect: The interaction effects of variety and spacings were found to be non-significant.

Conclusion

From above investigation, it can be concluded that Niger variety PNS-6 outperformed others in all yield parameters and economics and was closely followed by PhuleKarala. Among the different spacings, the closer spacing of 45 cm × 10 cm was found to be more remunerative for getting higher yield of Niger and economics which was closely followed by 45 cm × 15 cm.

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