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Performance of different cultivar of maize (*Zea mays* L.) for optimum growth, yield attributes and yield under field condition

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Abstract
The objective of this field experiment was to assess the development, productivity attributes, and overall effectiveness of various maize varieties when grown in a real-world agricultural setting. The research design involved three replications in a randomized block arrangement. We assessed five maize cultivars: T_1- JM218, T_2- JM215, T_3- PRMH – 306, T_4- JM – 8, T_5- JM – 13, and T_6- control. Among these varieties, PRMH-306 (referred to as V3-PRMH-306) consistently demonstrated superior performance across various parameters when compared to the other cultivars. The findings revealed that planting the PRMH-306 variety resulted in significantly greater growth indicators, including plant height, dry matter accumulation per plant, and the number of leaves per plant. Moreover, it exhibited excellent yield characteristics such as cobs per plant, seeds per cob, 100-grain weight, cob length, girth of cob, rows per cob, and grains per row. Notably, PRMH-306 also outperformed the control in terms of grain yield, Net monetary return (NMR), and Benefit-to-Cost (B:C) ratio. In summary, the PRMH-306 maize variety displayed outstanding performance in both grain and stover yield. Its grain yield, NMR, and B:C ratio were notably higher than those of the other maize cultivars under examination. The PRMH-306 variety emerged as the most economically advantageous choice, delivering the highest net financial returns (Rs. 54,909 per hectare) and a favourable B:C ratio of 2.81.

Keywords: Maize, varieties, growth and yield attributes

Introduction
Maize (*Zea mays* L.) is a substantial cereal crop in the Poaceae family and ranks third in terms of global productivity and cultivated area, following rice and wheat (Mishra *et al.*, 2019) [5]. Often stated to as the "queen of cereals," maize is favored for its short growing season, widespread cultivation, and high potential (Begam *et al.*, 2018) [4]. This conventional agricultural product serves multiple functions, encompassing nutrition, animal sustenance, and forage utilization (Barde *et al.*, 2021) [3].

Maize cultivation is widespread across the globe, with an extensive land area of 201 million hectares dedicated to its growth. This substantial cultivation effort results in a significant production of 1162 million metric tons, achieving a commendable productivity rate of 5754.7 kilograms per hectare (Mishra *et al.*, 2019) [5]. The United States holds the largest global area and production of rabi maize, followed by China and Brazil. In contrast, India ranks fourth in terms of cultivated area, with 8.05 lakh hectares, and seventh in production, generating 21.31 million metric tons. Notably, Tamil Nadu leads in maize production in India, with 23.10 million metric tons and an area of 3.98 lakh hectares in 2021. Other significant maize-producing states in India include Bihar, Maharashtra, Gujarat, West Bengal, and Telangana, contributing significantly to national maize production and demonstrating improved productivity in recent years (Anonymous 2020) [2].

Maize cultivation is resource-intensive due to its high nutrient demands. To sustain maize output, it is imperative to adopt organic nutrient management practices. Combining organic manures with chemical fertilizers in the right proportions can promote sustainable production. Varieties of maize such as JM 218, JM 215, PRMH-306, JM-8, and JM-13 are cultivated, although medium to late maturing cultivars can be vulnerable to water stress during the maturity stage.

Low productivity in rainfed lowland ecosystems is a common challenge in rice cultivation, with various factors contributing to this issue. One significant constraint is the absence of rice varieties that exhibit stress tolerance at different growth stages. Evaluating the performance of promising rice varieties in rainfed conditions is critical, especially given recent developments in midland and lowland habitat-adapted varieties.

Material and Methods

An agricultural research project took place during the 2022 winter cropping season at the Agriculture Farm, within the School of Agricultural Sciences at G. H. Raisoni, located in Saikheda Madhya Pradesh. This area encounters a sub-humid, sub-tropical climate marked by warm, arid summers and chilly, dry winters. The success of this study relied heavily on its available resources and research methodologies.

The field trial included five different maize cultivars as treatment groups, denoted as follows:

1) T_1 - JM218
2) T_2 - JM215
3) T_3 - PRMH – 306
4) T_4 - JM – 8
5) T_5 - JM – 13

Additionally, a control group labeled T_6 was also included in the experiment. To ensure robustness and reliability, the trial was designed using a RBD with 3 replications.

Result and Discussion

Effect on growth parameters

In general, during the initial phases of crop growth, the plant's height was at its lowest point. The various varieties had a notable impact on plant height, dry matter accumulation, and the number of leaves per plant at all growth stages. However, the most significant increase in plant height occurred between 30 and 45 days after sowing (DAS). PRMH – 306 consistently outperformed JM218, JM215, JM - 8, and JM - 13 in terms of plant height, dry matter accumulation, and the number of leaves per plant among the different varieties. It is noteworthy that the control group demonstrated a significant increase in the number of leaves per plant and dry matter accumulation while keeping plant height to a minimum. The research findings unequivocally indicate that dry matter accumulation (measured in grams per plant) steadily rose as the crop matured, reaching its peak at harvest across all treatment groups. These outcomes are in line with previous investigations conducted by scholars like Rahman *et al.* (2010) [8] and Barde *et al*. (2021) [3].

Effect on yield attributes

Table 2 presents clear evidence of the significant impact of different treatments on yield-related characteristics. Of all the treatments, the control group (T_6) resulted in the lowest values for these characteristics. Conversely, the PRMH-306 variety displayed the highest values across various yield-related attributes, including cobs/plant (2.00), seeds/cob (387.00), 100-grain weight (24.78), cob length (36.96), cob girth (13.97), number of rows/cob (13.67), and grain rows/cob (28.00). These findings align with previous research conducted by Abdulraheem *et al*. in 2018 [1] and Tahir *et al*. in 2008 [9].

Effect on yield characters

The maize yield is affected by multiple factors related to growth and yield, including crop dry matter accumulation, the quantity of grains/cob, and test weight. Table 4.2 demonstrates that the various treatments had a noteworthy influence on the maize harvest output.

The control treatment (T_1) resulted in the lowest grain and stover yields, with values of 1985 kg/ha and 6220 kg/ha, respectively. However, when different varieties of maize were cultivated in separate plots, both grain and stover yields increased. Among these varieties, PRMH – 306 exhibited the highest grain and stover yields, with values of 5781 kg/ha and 8190 kg/ha, respectively, surpassing all other varieties.

These findings align with previous research conducted by Otegui *et al.* (2005) [7], Olakojo and Kogbe (2005) [6], and Abdulraheem *et al*. (2018) [1].

Table 1: Effect of different cultivar on growth parameters of maize

T. No.	Treatment	Plant height (cm)			Dry matter accumulation (gm per plant)			No of leaves per plant		
		30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T_1	JM218	27.16	46.84	54.03	5.51	20.99	40.33	5.67	9.33	11.33
T_2	JM215	26.47	45.24	53.66	5.00	19.92	38.68	4.67	8.67	11.00
T_3	PRMH-306	28.68	48.00	57.14	6.36	22.50	41.61	7.33	10.67	13.00
T_4	JM – 8	25.93	40.47	51.66	4.53	18.90	37.89	4.33	8.33	9.67
T_5	JM – 13	25.98	40.61	50.58	4.26	18.20	36.14	4.33	7.67	9.00
T_6	Control	24.76	39.58	50.02	2.89	9.76	27.28	4.00	6.67	8.33
	SEm±	0.34	0.86	0.58	0.21	0.37	0.81	0.33	0.44	0.40
	CD (P=0.05)	1.08	2.74	1.86	0.66	1.20	2.57	1.05	1.41	1.29

Table 2: Effect of different cultivar on yield attributes and yields of maize

T. No.	Treatment	Cob/ plant	Seeds/cob	100 grain weight	Length of cob	Girth of cob	No. of row/cob	Grain/row	Grain yield (kg/ha)	Stover yield (kg/ha)
T_1	JM218	1.67	363.33	22.00	35.66	12.56	12.33	26.67	5451	8093
T_2	JM215	1.00	337.00	21.38	34.05	12.04	11.67	25.33	5315	7526
T_3	PRMH-306	2.00	387.00	24.78	36.96	13.97	13.67	28.00	5781	8190
T_4	JM-8	1.33	331.33	20.49	34.43	11.65	11.33	24.67	5221	7302
T_5	JM-13	1.67	324.00	20.14	33.05	11.33	11.33	24.00	5164	7258
T_6	Control	1.00	111.00	13.65	19.78	8.27	8.00	11.00	1985	6220
	SEm±	0.20	7.84	0.36	0.66	0.31	0.36	0.50	45	546
	CD (P=0.05)	0.64	25.03	1.15	2.10	0.99	1.15	1.60	145	1743

Conclusions

Based on the findings of this study, it can be inferred that the cultivation of PRMH-306 maize variety substantially improves growth, yield-related characteristics, and overall maize yield compared to other varieties tested. These results indicate that PRMH-306 is a scientifically sound choice for optimizing agronomic practices in sandy loam soil when cultivating maize in the Chhindwara region of Madhya Pradesh.

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