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Effect of fertility levels and foliar spray of liquid manure on the growth of *Rabi* sweet corn (*Zea mays* L. *saccharata*) under Humid Southern Rajasthan conditions

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Abstract

A field experiment entitled “Effect of Fertility Levels and Foliar Spray of Liquid Manure on the Growth of *Rabi* Sweet Corn (*Zea mays* L. *saccharata*) under Humid Southern Rajasthan Conditions” was conducted during the *rabi* season of 2025-26 at the Agricultural Research Station, Banswara, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan. The experiment comprised four fertility levels, viz., control, 50% RDF, 75% RDF and 100% RDF, and four foliar spray treatments, viz., control, Panchgavya @ 3%, Vermiwash @ 10% and Panchgavya @ 3% + Vermiwash @ 10%, thereby making sixteen treatment combinations replicated thrice in a Factorial Randomized Block Design (FRBD). The recommended dose of fertilizer was 150:60:40 kg N:P₂O₅:K₂O ha⁻¹, while foliar spray treatments were applied at 20, 40 and 60 days after sowing (DAS). Based on the results of the present investigation, application of 100% RDF significantly increased plant height (219.27 cm), dry matter accumulation (218.43 g plant⁻¹) and leaf area index (2.96), remaining statistically at par with 75% RDF. Among the foliar spray treatments, Panchgavya @ 3% + Vermiwash @ 10% applied at 20, 40 and 60 DAS recorded significantly higher plant height (207.43 cm), dry matter accumulation (198.80 g plant⁻¹) and leaf area index (2.64) over the control and remained statistically at par with Panchgavya @ 3% for most of the growth parameters. It may be concluded that application of 100% RDF in combination with foliar spray of Panchgavya @ 3% + Vermiwash @ 10% at 20, 40 and 60 DAS was the most effective treatment for improving the growth of *rabi* sweet corn under humid southern Rajasthan conditions.

Keywords: Dry matter accumulation, Fertility levels, Foliar spray, Growth, Panchgavya, *Rabi* sweet corn, Vermiwash.

Introduction

Sweet corn (*Zea mays* L. *saccharata*) is a high-value specialty maize cultivated for its tender kernels, high sugar content and superior eating quality. Owing to its short crop duration, increasing consumer preference and higher economic returns, its cultivation is expanding rapidly under irrigated production systems. However, being a nutrient-exhaustive crop, sweet corn requires a continuous and balanced supply of nutrients throughout its growth period to achieve optimum vegetative growth and biomass production. Balanced nutrient management plays a crucial role in improving plant growth, photosynthetic efficiency, dry matter accumulation and nutrient use efficiency.

Several researchers have demonstrated the importance of balanced fertilization in sweet corn production. Rasool *et al.* (2015) [6] reported that integrated nutrient management significantly increased plant height, dry matter accumulation and overall growth of sweet corn compared with the unfertilized control. Similarly, Rasool *et al.* (2016) [6] observed that balanced nutrient application improved vegetative growth, nutrient uptake and crop performance under temperate conditions. Liu *et al.* (2019) [4] also reported that efficient nutrient management enhanced nitrogen use efficiency, dry matter production and growth of sweet corn, emphasizing the importance of balanced fertilizer application for sustaining crop productivity.

Organic liquid manures have gained considerable attention as eco-friendly nutrient sources because they supply readily available nutrients along with beneficial microorganisms, enzymes and naturally occurring plant growth regulators. panchgavya, a fermented cow-based organic formulation, contains essential nutrients, beneficial microbes and growth-promoting substances that stimulate physiological and biochemical processes in plants. Vermiwash, a liquid extract obtained during vermicomposting, is rich in soluble nutrients, amino acids, enzymes, humic substances and microbial metabolites that enhance nutrient uptake and plant growth. Behera *et al.* (2024) ^[1] reported that panchgavya improves plant growth and physiological efficiency through the combined action of nutrients and bioactive compounds. Likewise, Golmei and Singh (2024) ^[3] observed significant improvement in the growth of sweet corn following foliar application of panchgavya, while Sinha *et al.* (2010) ^[8] highlighted the role of vermiwash in enhancing plant vigour, chlorophyll synthesis and nutrient utilization.

Although the individual benefits of balanced fertilization and organic liquid manures on crop growth have been widely reported, information on their combined effect under graded fertility levels on the growth of sweet corn is limited. Therefore, the present study was undertaken to evaluate the effect of fertility levels and foliar spray of liquid manure on the growth of *rabi* sweet corn (*Zea mays* L. *saccharata*) under Humid Southern Rajasthan conditions.

Materials and Methods

A field experiment was conducted during the *rabi* season of 2025-26 at the Agricultural Research Station, Banswara, Rajasthan, situated in the Humid Southern Plain (Agro-climatic Zone IV-b) of Rajasthan. The experimental soil was clay loam in texture, slightly acidic in reaction (pH 6.77), high in organic carbon (0.78%), medium in available nitrogen (272.64 kg ha⁻¹), medium in available phosphorus (20.00 kg ha⁻¹) and high in available potassium (343.45 kg ha⁻¹).

The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications, comprising four fertility levels, viz. control, 50% RDF, 75% RDF and 100% RDF, and four foliar spray treatments, viz. control, panchgavya @ 3%, vermiwash @ 10% and panchgavya @ 3% + vermiwash @ 10%, resulting in sixteen treatment combinations.

The test crop was sweet corn (cv. Sugar-75), sown at a spacing of 60 cm × 20 cm using a seed rate of 8 kg ha⁻¹. The recommended dose of fertilizer was 150:60:40 kg N:P₂O₅:K₂O ha⁻¹. Full doses of phosphorus and potassium, along with half of the recommended nitrogen, were applied as basal through diammonium phosphate (DAP), muriate of potash (MOP) and urea. The nitrogen supplied through DAP was adjusted from the total recommended nitrogen dose, and the remaining nitrogen was applied through urea in two equal splits at the knee-high and tasseling stages. Foliar spray treatments were imposed at 20, 40 and 60 DAS. All other recommended agronomic and plant protection practices were followed uniformly throughout the crop growing period.

Observations on plant height and dry matter accumulation were recorded at the specified growth stages following standard procedures. The experimental data were subjected to analysis of variance (ANOVA) appropriate for the Factorial Randomized Block Design as described by Gomez and Gomez (1984).

Treatment means were compared using the critical difference (CD) test at the 5% level of significance.

Results and Discussion

Effect of fertility levels

Fertility levels exerted a significant influence on the growth of *rabi* sweet corn (Tables 1 and 2). Application of 100% RDF recorded significantly higher plant height at 45 DAS (86.11 cm), 60 DAS (122.92 cm) and at harvest (219.27 cm), which remained statistically at par with 75% RDF (82.51, 115.84 and 202.81 cm, respectively), but was significantly superior to 50% RDF and the control. Similarly, dry matter accumulation was significantly higher under 100% RDF at 45 DAS (11.82 g plant⁻¹), 60 DAS (85.76 g plant⁻¹) and at harvest (218.43 g plant⁻¹), remaining statistically at par with 75% RDF (11.01, 78.95 and 206.70 g plant⁻¹, respectively). Leaf area index at 60 DAS also followed the same trend, with the highest value under 100% RDF (2.96), which was statistically comparable with 75% RDF (2.83).

The improved growth under higher fertility levels could be attributed to the balanced and adequate supply of nitrogen, phosphorus and potassium, which enhanced chlorophyll synthesis, photosynthetic activity, protein synthesis and other metabolic processes, resulting in rapid cell division, cell elongation and greater biomass accumulation. Adequate nutrient availability also promoted leaf expansion, improved canopy development and increased interception of solar radiation, thereby enhancing dry matter production and leaf area development throughout the crop growth period. Similar findings have also been reported by Ramaraju *et al.* (2021) and Sharma *et al.* (2025) ^[7].

Effect of foliar spray of liquid manure

Foliar application of liquid manure significantly improved the growth of *rabi* sweet corn (Tables 1 and 2). Among the treatments, panchgavya @ 3% + vermiwash @ 10% recorded significantly higher plant height at 45 DAS (77.52 cm), 60 DAS (113.11 cm) and at harvest (207.43 cm), which remained statistically at par with panchgavya @ 3% (74.31, 107.09 and 191.27 cm, respectively). The same treatment also produced the highest dry matter accumulation at 45 DAS (11.30 g plant⁻¹), 60 DAS (79.26 g plant⁻¹) and at harvest (198.80 g plant⁻¹), along with the maximum leaf area index (2.64) at 60 DAS, and remained statistically comparable with panchgavya @ 3% for most of the growth parameters.

The superior growth obtained with the combined application of panchgavya and vermiwash may be attributed to their complementary effects on plant nutrition and physiology. Panchgavya supplies essential nutrients, naturally occurring phytohormones, vitamins and beneficial microorganisms, whereas vermiwash contains readily available nutrients, growth-promoting substances, enzymes and beneficial microorganisms that enhance nutrient availability and stimulate plant growth. Foliar application facilitates rapid absorption of these bioactive compounds, thereby improving metabolic activity, chlorophyll synthesis and photosynthetic efficiency, ultimately resulting in greater plant height, dry matter accumulation and leaf area development. Similar beneficial effects of foliar application of panchgavya and vermiwash on crop performance have also been reported by Gajjela and Chatterjee (2019) ^[2], while Golmei and Singh (2024) ^[3] also reported improved growth of sweet corn following panchgavya application.

Table 1: Effect of fertility levels and foliar spray of liquid manure on plant height (cm) of *rabi* sweet corn (*Zea mays* L. *saccharata*)

Treatments	Plant height (cm)		
	45 DAS	60 DAS	At harvest
Fertility Levels			
N ₀ :Control	56.01	84.69	159.23
N ₁ :50% RDF	68.58	102.41	182.36
N ₂ :75% RDF	82.51	115.84	202.81
N ₃ :100% RDF	86.11	122.92	219.27
S.Em.±	1.82	2.96	5.72
C.D. (P= 0.05)	5.27	8.54	16.53
Foliar spray Levels			
M ₀ :Control	69.21	101.12	174.38
M ₁ :Panchgavya @ 3%	74.31	107.09	191.27
M ₂ :Vermiwash @ 10%	72.17	104.54	190.59
M ₃ :Panchgavya @ 3% + Vermiwash @ 10%	77.52	113.11	207.43
S.Em.±	1.82	2.96	5.72
C.D. (P= 0.05)	5.27	8.54	16.53

Table 2: Effect of fertility levels and foliar spray of liquid manure on dry matter accumulation (g plant⁻¹) and LAI of *rabi* sweet corn (*Zea mays* L. *saccharata*)

Treatments	Dry matter accumulation (g plant ⁻¹)			Leaf area index
	45 DAS	60 DAS	At harvest	60 DAS
Fertility Levels				
N ₀ :Control	9.02	53.73	142.88	1.83
N ₁ :50% RDF	10.04	67.26	175.72	2.27
N ₂ :75% RDF	11.01	78.95	206.70	2.83
N ₃ :100% RDF	11.82	85.76	218.43	2.96
S.Em.±	0.31	2.58	5.12	0.06
C.D. (P= 0.05)	0.90	7.46	14.78	0.17
Foliar spray Levels				
M ₀ :Control	9.73	64.48	176.91	2.32
M ₁ :Panchgavya @ 3%	10.47	72.53	185.91	2.48
M ₂ :Vermiwash @ 10%	10.39	69.43	182.13	2.44
M ₃ :Panchgavya @ 3% + Vermiwash @ 10%	11.30	79.26	198.80	2.64
S.Em.±	0.31	2.58	5.12	0.06
C.D. (P= 0.05)	0.90	7.46	14.78	0.17

Conclusion

Based on the findings of the present investigation, it can be concluded that fertility levels and foliar application of liquid manure significantly influenced the growth of *rabi* sweet corn. Application of 100% RDF produced the highest plant height, dry matter accumulation and leaf area index, remaining statistically at par with 75% RDF for most of the growth parameters. Among the foliar spray treatments, panchgavya @ 3% + vermiwash @ 10% recorded significantly superior growth over the control and remained statistically at par with panchgavya @ 3% for most of the observations. Thus, application of 100% RDF along with foliar spray of panchgavya @ 3% + vermiwash @ 10% proved to be the most effective treatment for improving the growth of *rabi* sweet corn under Humid Southern Rajasthan conditions.

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