



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(8): 125-127
Received: 02-06-2026
Accepted: 08-07-2026

Shalini Meena
Ph.D. Research Scholar, College of
Agriculture, Ummedganj, Kota,
Rajasthan, India

RK Meena
Agriculture Research Station,
Kota, Rajasthan, India

BS Meena
Agriculture Research Station,
Kota, Rajasthan, India

MK Sharma
Agriculture Research Station,
Kota, Rajasthan, India

Yamini Tak
Agriculture Research Station,
Kota, Rajasthan, India

BK Patidar
Agriculture Research Station,
Kota, Rajasthan, India

Corresponding Author:
Shalini Meena
Ph.D. Research Scholar, College of
Agriculture, Ummedganj, Kota,
Rajasthan, India

Influence of tillage practices, fertility levels and liquid biofertilizer on growth, productivity and profitability of Wheat (*Triticum aestivum* L.)

Shalini Meena, RK Meena, BS Meena, MK Sharma, Yamini Tak and BK Patidar

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i8b.6212>

Abstract

A field experiment was conducted during the *rabi* season to evaluate the effects of tillage practices, fertility levels, and liquid biofertilizer on yield attributes, yield, and economics of wheat (*Triticum aestivum* L.) under the agro-climatic conditions of South-Eastern Rajasthan. The experiment was laid out in a split-split plot design with four replications. The treatments comprised three tillage practices, viz., conventional tillage, minimum tillage, and zero tillage; three fertility levels, viz., 125% RDF, 100% RDF, and 75% RDF; and two liquid biofertilizer treatments, viz., no biofertilizer and NPK liquid biofertilizer. The results revealed that conventional tillage significantly enhanced effective tillers per meter of row length, grains per spike, test weight, grain yield, straw yield, biological yield, and net returns over zero tillage and remained at par with minimum tillage. Among fertility levels, application of 125% RDF recorded the highest values of yield attributes, yield and economic returns, followed by 100% RDF, whereas 75% RDF resulted in the lowest performance. The application of liquid NPK biofertilizer significantly improved yield attributes, grain yield, straw yield, biological yield, and economic returns compared with no biofertilizer.

Keywords: Wheat, tillage practices, fertility levels, liquid biofertilizer, yield attributes, economics

Introduction

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops cultivated worldwide and serves as a staple food for a large segment of the population (Parewa *et al.* 2019). In India, wheat is the second most important food crop after rice and contributes significantly to national food security, employment generation and the agricultural economy. India is the second largest producer of wheat with an area of 32.8 million ha and production of 1117.9 million tons (DA&FW, 2025) ^[1]. Rajasthan occupies approximately 3.17 million hectares with a production of 112.27 million tonnes (Anonymous 2025). In recent years, sustaining higher wheat productivity has become increasingly challenging due to declining soil fertility, deterioration of soil physical properties, imbalanced fertiliser use, increasing production costs and changing climatic conditions. Therefore, the adoption of sustainable crop management practices has become essential to maintain productivity while conserving natural resources. Various tillage practices play a vital role in improving soil physical properties, seedbed preparation, soil aeration, moisture conservation and root proliferation, thereby influencing crop establishment, growth and productivity (Kukal, S. S., & Sidhu, A. S. 2004) ^[4], while balanced nutrient application not only improves photosynthetic activity, biomass accumulation and yield attributes but also enhances nutrient uptake and fertilizer use efficiency, resulting in higher grain yield and quality (Ansari *et al.*, 2015). Liquid biofertilizers have emerged as an eco-friendly component of integrated nutrient management. They improve nutrient solubilization and biological nitrogen fixation, stimulate beneficial microbial populations in the rhizosphere and promote root growth through the production of plant growth-promoting substances (Chand, 2007) ^[2]. The combined adoption of suitable tillage practices, optimum fertility levels and liquid biofertilizers can improve crop productivity, profitability and soil health, thereby contributing to sustainable wheat production.

Materials and Methods

A field experiment was conducted during the rabi season at the Instructional Farm, College of Agriculture, Ummedganj, Kota, Rajasthan. The experimental field was characterized by clay loam soil. The experiment was laid out in a split-split plot design with four replications. The treatments consisted of three tillage practices, viz., conventional tillage, minimum tillage and zero tillage, assigned to the main plots; three fertility levels, viz., 125% recommended dose of fertilizers (RDF), 100% RDF and 75% RDF, allotted to the sub-plots; and two liquid biofertilizer treatments, viz., no biofertilizer and liquid NPK biofertilizer, allocated to the sub-sub plots. The wheat variety Raj 4079 was sown using a seed rate of 100 kg/ha with a row spacing of 22.5 cm. The recommended doses of nitrogen, phosphorus and potassium were supplied through urea, DAP and MOP, respectively. Fertilizers were applied by the broadcasting method according to the allotted plot. The entire quantity of phosphorus and potassium and half of the nitrogen were applied as a basal dose at the time of sowing, while the remaining half of the nitrogen was top-dressed at the first irrigation to ensure adequate nutrient availability during the crop growth period. The liquid NPK biofertilizer was applied through seed treatment prior to sowing as per the recommended procedure. All other recommended agronomic and plant protection practices were followed uniformly throughout the crop-growing period to raise a healthy wheat crop.

Results and Discussion

Effect on growth

The growth parameters of wheat, viz., plant height and dry matter

accumulation at 30, 60, 90 DAS and at harvest, were significantly influenced (Table 1) by tillage practices, fertility levels and liquid biofertilizer application. Among the tillage practices, conventional tillage recorded the highest plant height and dry matter accumulation at all growth stages, which remained statistically at par with minimum tillage but was significantly superior to zero tillage. With respect to fertility levels, application of 125% RDF produced significantly higher plant height and dry matter accumulation than 75% RDF; however, it remained statistically at par with 100% RDF at all stages of crop growth. Application of NPK liquid biofertilizer through seed treatment significantly increased plant height and dry matter accumulation over the no-biofertilizer treatment throughout the crop growth period.

Effect on yield and yield attributes

The pooled analysis of data revealed (Table 2) that the yield attributes of wheat, viz., effective tillers per meter row length, number of grains per spike and test weight, were significantly influenced by tillage practices, fertility levels and liquid biofertilizer application. Among the tillage practices, conventional tillage recorded the highest values of all yield attributes and was at par with minimum tillage, whereas zero tillage resulted in the lowest values. Under fertility levels, application of 125% RDF significantly improved yield attributes 75% RDF and did not differ statistically from 100% RDF. Application of NPK liquid biofertilizer significantly increased effective tillers, grains per spike and test weight over no biofertilizer.

Table 1: Effect of tillage practices, fertility levels and liquid biofertilizers on plant height and dry matter accumulation of wheat

Treatments	Plant height (cm)				DMA (g/plant)			
	30 DAS	60 DAS	90 DAS	At harvest	30 DAS	60 DAS	90 DAS	At harvest
Tillage practices								
Zero tillage	19.38	38.35	75.14	81.29	1.21	4.64	12.65	15.96
Minimum tillage	22.01	42.09	82.16	88.44	1.34	5.31	14.04	17.65
Conventional tillage	22.92	43.94	85.33	92.04	1.40	5.51	14.45	18.18
SEm±	0.33	0.68	1.62	1.30	0.03	0.07	0.14	0.18
CD (P=0.05)	1.01	2.06	5.60	4.00	0.08	0.20	0.41	0.55
Fertility levels								
75% RDF	20.09	39.80	77.08	81.57	1.25	4.94	13.06	16.44
100% RDF	21.78	42.80	82.63	88.56	1.37	5.43	14.15	17.78
125% RDF	22.52	44.02	85.13	91.14	1.40	5.59	14.47	18.20
SEm±	0.26	0.52	1.36	1.21	0.02	0.06	0.11	0.15
CD (P=0.05)	0.76	1.54	4.05	3.60	0.05	0.17	0.29	0.44
Liquid biofertilizers								
No biofertilizer	19.63	39.63	80.21	85.29	1.33	4.99	12.35	15.86
NPK liquid biofertilizer	20.90	41.95	83.45	88.89	1.38	5.41	13.23	17.31
SEm±	0.18	0.36	0.87	0.53	0.01	0.04	0.09	0.11
CD (P=0.05)	0.55	1.08	2.62	1.59	0.03	0.12	0.26	0.32

The grain yield, straw yield and biological yield of wheat were also significantly influenced by tillage practices, fertility levels and liquid biofertilizer application. Among the tillage practices, conventional tillage recorded the highest grain (55.20 q/ha) and straw (70.92 q/ha) which remained statistically at par with minimum tillage but was significantly superior to zero tillage, based on pooled data. With respect to fertility levels, application of 125% RDF produced significantly higher grain (55.42 q/ha) and straw yield (71.64 q/ha) than 75% RDF; however, it remained statistically at par with 100% RDF. Based on pooled data, it was observed that application of NPK liquid biofertilizer through seed treatment significantly increased grain (49.91q/ha) and straw yield (63.85 q/ha) over the no biofertilizer treatment.

The higher growth, yield attributes and yield obtained under conventional tillage and minimum tillage may be attributed to improved soil physical conditions, including lower bulk density, better soil aeration, enhanced moisture availability and greater root proliferation, which facilitated efficient nutrient uptake and photosynthetic activity. These favourable conditions promoted better crop growth, higher dry matter production and efficient translocation of assimilates from source to sink, ultimately resulting in increased grain, straw and biological yields (Timalsina *et al.* 2021 and Vijaya *et al.* 2022) [8, 10]. In contrast, zero tillage recorded comparatively lower yields due to higher soil compaction, restricted root growth and comparatively lower availability of moisture and nutrients during critical growth

stages. The superiority of 125% RDF may be ascribed to the adequate and balanced supply of essential nutrients throughout the crop growth period, leading to enhanced chlorophyll synthesis, photosynthetic efficiency, dry matter accumulation and better partitioning of assimilates towards economic yield, thereby increasing grain, straw and biological yields (Meena and Meena, 2020, Kumawat *et al.* 2021 and Tiwari *et al.* 2021) [7, 5, 9]. The

beneficial effect of liquid NPK biofertilizer could be attributed to enhanced microbial activity in the rhizosphere, biological nitrogen fixation, solubilization and mobilization of nutrients, production of plant growth-promoting substances and improved nutrient uptake, which collectively enhanced crop growth, biomass production and yield (Kumawat *et al.* 2020 and Jain *et al.* 2021) [6, 3].

Table 2: Effect of tillage practices, fertility levels and liquid biofertilizers on yield attributes, yield and economics of wheat

Treatments	Effective tillers (nos./mrl)	Grains/spike (nos.)	Grain yield (q/ha)	Straw yield (q/ha)	HI (%)	Net returns (₹/ha)	B:C ratio
Tillage practices							
Zero tillage	129.5	38.58	43.29	58.86	42.38	81901	2.55
Minimum tillage	136.4	41.17	53.29	69.06	43.55	102219	2.88
Conventional tillage	139.1	41.67	55.20	70.92	43.76	103658	2.67
SEm±	0.98	0.31	0.62	1.57	0.71	1621	0.03
CD (P=0.05)	2.94	0.98	1.91	4.71	NS	4863	0.10
Fertility levels							
75% RDF	132.9	39.44	47.26	63.79	42.56	86793	2.41
100% RDF	137.5	41.20	53.57	69.68	43.46	100097	2.67
125% RDF	140.4	41.74	55.42	71.64	43.61	104538	2.71
SEm±	1.01	0.38	0.63	1.59	0.64	1557	0.03
CD (P=0.05)	3.02	1.12	1.90	4.80	NS	4898	0.08
Liquid biofertilizers							
No biofertilizer	131.1	39.18	42.80	58.44	42.27	79239	2.46
NPK liquid biofertilizer	135.8	41.07	49.91	63.85	43.62	94121	2.81
SEm±	0.79	0.27	0.65	1.04	0.51	1632	0.02
CD (P=0.05)	2.37	0.82	1.94	3.15	NS	4671	0.08

Economics

Economic analysis revealed that among tillage practices, conventional tillage recorded the highest net returns (₹103658/ha) and was at par with minimum tillage, whereas zero tillage resulted in the lowest economic returns. But B:C ratio was significantly higher under minimum tillage (2.88) due to the lower cost of cultivation. Among fertility levels, application of 125% RDF generated the maximum net returns (₹104538/ha) and benefit-cost ratio, closely followed by 100% RDF. The lower economic returns observed under 75% RDF were primarily due to reduced yields resulting from inadequate nutrient supply. NPK liquid biofertilizer significantly improved net returns (₹94121/ha) and B:C ratio (2.81) over no biofertilizer treatment.

Conclusion

Based on the two-year field experiment, it can be concluded that among tillage practices, conventional tillage recorded higher growth parameters, yield attributes and yields (55.20 q/ha grain yield and 70.92 q/ha straw yield) with higher net returns (₹103658/ha) and was found statistically at par with minimum tillage. Among fertility levels, 125% RDF produced superior productivity (55.42 q/ha grain yield) and profitability (₹104538/ha net returns), followed by 100% RDF. And for the liquid biofertilizer treatment, application of NPK liquid biofertilizer registered higher growth parameter, yield attributes and yield (grain yield 49.91 q/ha) and net returns (₹94121/ha) compared to no biofertilizer.

References

1. Directorate of Economics and Statistics. Agriculture statistics at a glance 2024-25. New Delhi: Ministry of Agriculture and Farmers Welfare, Government of India; 2024.
2. Chand S. Effect of integrated nutrient management on yield and nutrient use efficiency in mustard (*Brassica juncea* L.). SAARC Journal of Agriculture. 2007;5(2):93-100.
3. Jain D, Meena RH, Choudhary J, Sharma SK, Chauhan S, Bhojiya AA, *et al.* Effect of microbial consortia on growth and yield of wheat under Typic Haplusteps. Plant Physiology Reports. 2021;26(3):570-580.
4. Kukal SS, Sidhu AS. Soil physical properties and crop performance in a rice-wheat cropping system in India under different tillage regimes and straw management. Soil and Tillage Research. 2004;72(1):1-11.
5. Kumawat H, Singh DP, Jat G, Choudhary R, Singh PB, Dhayal S, *et al.* Effect of fertility levels and liquid biofertilizers on growth and yield of wheat (*Triticum aestivum* L.). The Pharma Innovation Journal. 2021;10(9):1365-1369.
6. Kumawat N, Yadav K, Singh M, Dudwe TS, Tomar IS. Effect of phosphorus and bioinoculants and their residual effect on succeeding chickpea (*Cicer arietinum*). Indian Journal of Agricultural Sciences. 2020;90(2):320-325.
7. Meena RK, Meena NL, Yadav BD. Influence of fertility levels and biofertilizers on yield and nutrient uptake of wheat in Typic Haplusteps of south-eastern Rajasthan. Journal of Pharmacognosy and Phytochemistry. 2020;9(5):1580-1584.
8. Timalisina HP, Marahatta S, Sah SK, Gautam AK. Effect of tillage method, crop residue and nutrient management on growth and yield of wheat in rice-wheat cropping system at Bhairahawa condition. Agronomy Journal of Nepal. 2021;5.
9. Tiwari RC, Singh Y, Tiwari S. Nutrient management in wheat under varying NPK levels. Indian Journal of Agronomy. 2013;58(1):95-98.
10. Vijaya P, Sreelatha D, Padmaja B, Rajaiah P. Performance of planters under different tillage practices on growth, yield, energy use efficiency, and economics of rabi maize. International Journal of Environment and Climate Change. 2022;12(11):2289-2299.