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Performance of wheat (*Triticum aestivum* L.) under foliar application of dasagavya and fermented buttermilk as organic source of nutrition

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Abstract
A field experiment was conducted during *Rabi* 2020-21 at Experimental farm of University Institute of Agricultural Sciences, Chandigarh University, Gharuan (Mohali) to study the performance of wheat (*Triticum aestivum* L.) under foliar application of dasagavya and fermented buttermilk as organic source of nutrition. There were total nine treatments comprising of wheat with treatment T_1 - Control, T_2 - 1% dasagavya + 2.5t/ha FYM, T_3 – 2% dasagavya + 2.5t/ha vermicompost, T_4 – 3% dasagavya + 5t/ha FYM, T_5 – 4% dasagavya + 5t/ha vermicompost, T_6 – 2.5% fermented buttermilk + 2.5t/ha FYM, T_7 – 5% fermented buttermilk + 2.5t/ha vermicompost, T_8 – 7.5% fermented buttermilk + 5t/ha FYM and T_9 – 10% fermented buttermilk + 5t/ha vermicompost. The experiment was laid down in randomized block design with three replications. Growth parameters i.e. plant height was maximum at harvesting in treatment T_4 (84.01 cm) followed by treatment T_8 (82.07 cm), dry matter accumulation at harvesting in treatment T_4 (211.79) was highest followed by treatment T_8 (208.46). Yield attributes, grain yield was the highest in treatment T_4 (8.63 q/ha) followed by treatment T_8 (43.55 q/ha) and straw yield recorded the highest in treatment T_4 (69.23 q/ha) followed by treatment T_8 (64.64kg/ha). Among all the treatments T_4 - 3% dasagavya + 5t/ha FYM gave the best results. Highest net return of Rs.66144/ha and Rs.1.96 as net return per rupee invested were recorded in treatment T_4 followed by treatment T_5 in which net return was Rs.63695.50 and net return per rupee invested is Rs.1.85.

Keywords: *Triticum aestivum* L, dasagavya, buttermilk

Introduction

Wheat (*Triticum aestivum* L.) is the second most important cereal crop in the world after rice. Also one of the most important stable food crop of world. Its contribution to the total of food grain production of the country is about 25%. Wheat is a cereal grain, originated from the Levant region but now cultivated in at least 43 countries of the world. The countries leading in cultivation of wheat are China, Thailand, Indonesia and U.S.A. Globally it is cultivated on an area of 224.72 million ha (anonymous, 2019) [1] with the production and productivity of 734.62 million tones and 3.27 tonnes per ha, respectively (anonymous, 2019) [1]. India is the second largest producer of the wheat in world after China. In Punjab region the area under wheat cultivation is 3.4 million hectares with a production of 14.9 million tonnes and productivity of 4.3 tonnes per hectare (anonymous, 2019) [2]. No other crop is grown more than wheat crop. Also world trade in wheat is greater than all other crops combined.

Traditionally organic manures are used for supplying plant nutrients. It provides nutrients in an efficient way. They improve the soil conditions, soil quality and sustainable crop production. Organic change had positive but variable effects. The wheat yield is increased by 11.13 (105 %) to 13.53 (128 %) g pot^{-1}, by the application of organic manures. Organic farming is increasing in recent years due to the realization of inherent advantages it confers in sustaining crop production and also in maintaining soil nutrients, texture and healthy eco-system. (Gunasekar and Kumar, 2013) [5]. Farmyard manure, compost, vermicompost, green manuring, agro-wastes and plant wastes are good sources of soil organic carbon (Kumar *et al*., 2011) [6] and supply of plant nutrients traditionally. In the existing technology of organic farming where FYM and compost are used as sources of nutrient supply, productivity of soil depletes during the transitory period (until fertility, structure and microbial activity of soil have been restored) leading to low yield levels in initial years of cultivation (Reddy *et al*., 2011) [9]. Besides, in the light textured soils of arid and semi-arid regions bulky organic materials remain in undecomposed state for years due to inherent deficiency of soil organic carbon and microbial biomass responsible for decomposition of these materials. Hence it is imperative to evolve an alternative technology of organic farming that provides reasonable yields while restoring the fertility of soil during transitory period. The use of fermented, liquid organic fertilizers, effective microorganisms (EM) as foliar fertilizers have been introduced to modern agriculture in recent years to produce food with good quality and safety. Use of fermented buttermilk rich in beneficial microorganisms, is also practiced elsewhere both to augment plant growth and suppress pest loads on crop plants. The benefits of EM in increasing crop yields, improving crop quality and protecting plant from pests and disease have been demonstrated for a wide range of crops and soil conditions. In India, panchagavya is widely used organic formulations, which is prepared by farmers themselves. This is improvised as dasagavya with the addition of ten products. The ingredients of dasagavya includes 50% panchagavya, 25% certain plant extracts and 25% other organic inputs that enhances the nutrient pool and microbial growth. Dasagavya is proven to have miraculous

effects on plant growth with identified proportions after proper analysis on field and soil, for different crops. Dasagavya also has other advantages like improving the yield qualitatively and quantitatively. It controls pests like aphids, thrips, mites and other sucking pests. Resistance of diseases is improved as leaf spot, leaf blight, powdery mildew etc. are controlled (Selvaraj and Anitha, 2007) [10]. Dasagavya is an essential package of nutrient management as it is obtained from organic sources which is suitable and compatible to various crops. Dasagavya is a foliar nutrition prepared by organic growers as an indigenous material that used widely for agricultural and horticultural crops. Dasagavya contains several macro and micro nutrients, also contains various amino acids, vitamins, growth regulators like auxins, gibberellins and beneficial micro-organisms like pseudomonas, azatobacter and phosphor bacteria etc. In recent years, the good quality and safe food is produced by the use of fermented, organic fertilizers.

Materials and Methods

This experiment was conducted during the 2019-2020 *Rabi* season at Experimental Research Farm, UIAS of Chandigarh University, Gharuan (Mohali) to study the growth and development of Wheat (*Triticum aestivum* L.) under foliar application of dasagavya and fermented buttermilk. The experiment was laid out in a Randomized block design with three replications having a plot size of 4m x 3m. Wheat variety Unnat PBW-343 was sown on 14-12-2019. During this study nine different treatments with T_1- Control, T_2 - 1% dasagavya +2.5t/ha FYM, T_3– 2% dasagavya+2.5t/ha vermicompost, T_4 – 3% dasagavya + 5t/ha FYM, T_5 – 4% dasagavya + 5t/ha vermicompost, T_6– 2.5% fermented buttermilk + 2.5t/ha FYM, T_7 – 5% fermented buttermilk + 2.5t/ha vermicompost, T_8 – 7.5% fermented buttermilk + 5t/ha FYM and T_9 – 10% fermented buttermilk + 5t/ha vermicompost were evaluated. Data was analyzed for growth and yield attributing characters such as plant height (cm), dry matter accumulation (m2), number of spikelets/spike, test weight and grain yield were recorded. The data recorded on different aspects in the present study was subjected to the statistical analysis using analysis of variance as per procedure recommended by Gomez and Gomez (1984) [4].

Results and Discussion

Effect of different sowing methods and seed rate on growth parameters (plant height and dry matter accumulation) and yield attributes (length of spike, number of grains/spike and test weight).

Plant Height

The data on plant height recorded at harvest stage and dry matter accumulation at harvest stage are presented in Table 1. The plant height continues to increase from 30 DAS till harvest under all the treatments. The increase in plant height was maximum between 30 to 60 DAS and thereafter it was only marginal to harvest. At all the stages of crop growth, significantly taller plants were observed in treatment T_4 – 3% dasagavya+5t/ha FYM (84.01), whereas, T_1- control was recorded the lowest plant height (73.49). Sureshkumar *et al.* (2011) [11] also recorded the same results. This might be due to application of dasagavya.

Table 1: Effect of treatments on plant height and dry matter accumulation

Treatments	Plant height (Harvesting)	Dry matter Accumulation (Harvesting)
T_1-Control	73.49	161.35
T_2 -1% dasagavya +2.5t/ha FYM	79.32	205.14
T_3- 2% dasagavya+2.5t/ha vermicompost	79.55	206.22
T_4- 3% dasagavya+5t/ha FYM	84.01	211.79
T_5-4% dasagavya+ 5t/ha vermicompost	81.55	207.56
T_6-2.5% fermented buttermilk + 2.5t/ha FYM	79.88	207.38
T_7-5% fermented buttermilk + 2.5t/ha vermicompost	79.46	206.65
T_8-7.5% fermented buttermilk + 5t/ha FYM	82.07	208.46
T9-10% fermented Buttermilk + 5t/ha vermicompost	79.92	207.41
CD (P=0.05)	NS	0.51

The data pertaining to dry matter accumulation (g/m^2) at different growth stages as influenced by various treatments are presented in Table 1 and depicted. Dry matter accumulation increased progressively with the advancement of crop age. Most dry matter accumulation between 90 DAS and at harvest time. There is significantly more dry matter in T_4 at all the stages of growth and harvest, respectively followed by other treatments. The most dry matter (211.79) was produced by T_4 – 3% dasagavya+5t/ha FYM at harvesting stage. The dry matter accumulation was recorded the least in T_1 – Control (161.35). An overall similar result obtained by Choudhary *et al.* (2017) [3]. This could be due to the reason that application of dasagavya and vermicompost improved the growth of crop.

Table 2: Effect of treatments on length of spikes, number of grains/spike, test weight, and grain yield.

Treatments	Length of spike (cm)	Number of grain/spike	Test weight (1000 seed/g)	Grain yield (q/ha)
T_1-Control	8.79	32.43	38.92	19.29
T_2 -1% dasagavya +2.5t/ha FYM	9.89	36.10	41.68	34.50
T_3- 2% dasagavya+2.5t/ha vermicompost	10.12	36.43	41.61	39.42
T_4- 3% dasagavya+5t/ha FYM	11.52	40.43	44.83	48.63
T_5-4% dasagavya+ 5t/ha vermicompost	10.46	36.12	42.41	41.78
T_6-2.5% fermented buttermilk + 2.5t/ha FYM	9.96	36.77	40.25	33.26
T_7-5% fermented buttermilk + 2.5t/ha vermicompost	9.62	34.77	40.36	38.66
T_8-7.5% fermented buttermilk + 5t/ha FYM	10.71	38.43	42.55	43.55
T9-10% fermented Buttermilk + 5t/ha vermicompost	9.91	35.77	41.07	40.25
CD (P=0.05)	0.50	1.07	0.43	0.35

Length of spike (cm)

Critical analysis of data (Table 2) revealed that length of spikes markedly increased with dasagavya and FYM application by various days. There is significant increase in length of spike (11.52 cm) with T_4– 3% dasagavya+5t/ha FYM which is the highest and the lowest in T_1-control (8.79cm). These similar findings were also observed by Pal and Patel (2020) [7].

Number of grains/spike

Data pertaining to number of grains/spike presented was significantly affected by treatment in Table 2 showng significant increase in grains per spike (40.43) with T_4 – 3% dasagavya+5t/ha FYM which was the highest and the lowest (32.43) was recorded in T_1 -control. These similar findings were also observed by Vimalendran *et al.* (2013) [12].

Test weight

The data pertaining to test weight is given in Table 2. The data clearly showed that the T_4 – 3% dasagavya + 5t/ha FYM resulted in significant increase in the test weight which was (43.73 g) and the lowest was in T_1-control (37.92 g). Similar results were obtained by Panchal *et al.* (2017) [8]. This could be due to the reason that application of dasagavya and FYM during the growth stages of crop improved grain size and quality.

Grain yield

Grain yield of wheat as influenced by application of different treatments as given in Table 2. A careful purview of data revealed that grain yield was significantly higher (48.63 q/ha) under T_4 – 3% dasagavya+5t/ha FYM than the other treatments. It was the lowest in T_1- control (19.29q/ha). Similar results were obtained by Kumar *et al.* (2011) [6]. This might be due to the reason that, dasagavya and FYM conatin high nitrogen concentration and improved the grain yield.

Conclusion

1. The best combination was found to be T_4 - 3% dasagavya+5t/ha FYM with highest production potential in terms of wheat yield (48.63q/ha) under organic conditions.
2. Highest net returns of Rs.66144.00/ha and highest net returns per rupee invested (1.96) were obtained from T_4 - 3% dasagavya+5t/ha FYM.

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