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Growth and development of wheat (*Triticum aestivum* L.) under foliar application of panchagavya and fermented buttermilk

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Abstract
A field experiment was conducted during Rabi 2020 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 panchagavya and fermented buttermilk. There were total nine treatments comprising of wheat with treatment details were T1-Control, T2-2.5 ltr Panchagavya +2.5t/ha FYM, T3–5 ltr Panchagavya+2.5t/ha Vermicompost, T4 – 7.5 ltr Panchagavya+5t/ha FYM, T5–10 ltr Pancahagavya+ 5t/ha Vermicompost, T6–2.5 ltr Fermented Buttermilk + 2.5t/ha FYM, T7–5 ltr Fermented Buttermilk + 2.5t/ha Vermicompost, T8 – 7.5 ltr Fermented Buttermilk + 5t/ha FYM, T9 – 10 ltr Fermented Buttermilk + 5t/ha Vermicompost. The experiment was laid down in Randomized block design with three replication. Growth parameters i.e. plant height (82.91 cm) and dry matter accumulation (210.69 g/m2) at harvesting in treatment T4- 7.5 ltr Panchagavya+5t/ha FYM was significantly superior over other treatment. Yield attributes. i.e length of spike (10.42cm), no. of grain/spike (39.33) and test weight (42.63) was maximum in T4- 7.5 ltr Panchagavya+5t/ha FYM. Grain yield (47.53q/ha), straw yield (68.13q/ha), harvesting index (41.09%) was also maximum in T4-7.5 ltr Panchagavya+5t/ha FYM. Highest net returns Rs 90087.75 and net returns per rupee invested of Rs2.18 was recorded in treatment T4.

Keywords: organic treatment, growth and development

Introduction

Wheat *(Triticum aestivum* L.*)* is second most important cereal crop in the world after rice. Also one of the most important stable food crop of world. It contribute the total of food grain production of the country about 25%. Wheat is cereal grain, originated from the Levant region (Feldman and Mordechai, 2007) but now cultivated in at least 43 countries of the world. The country 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 with the production and productivity of 734.62 million tones and 3.27 tonnes per ha, respectively (Anonymous, 2016). 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 ha with a production of 14.9 million tones and productivity of 4.3 tones per ha (Anonymous, 2019-2020). No other crop is grown more than wheat crop (220.4 million hectares). Also World trade in wheat is greater than for 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 realization of inherent advantages it confers in sustaining crop production and also in maintaining soil nutrient, texture and safe environment (Lokanath and Parameshwarappa, 2006). Farmyard manure, compost, vermicompost, green manuring, agro-wastes and plant wastes are the good source of soil organic carbon (Tolanur and Badanur, 2003) 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 (Natarajan, 2002). 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 (Galindo *et al.*, 2007). Use of fermented curd, 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 (PG) is widely used organic formulations, which is prepared by farmers themselves. It reduces the cost of cultivation.

Panchagavya is a term used in Ayurveda which means fermented product made from five ingredients obtained from cow, such as milk, urine, dung, curd and clarified butter. Panchagavya is very effective in enhanced the biological efficiency of crop and the quality of fruits and vegetables production. It helps to improve soil fertility and enhance crop productivity and quality of product. It also work as a pest-repellent. It has the potential to play the role of promoting growth and providing immunity in plant system hence confers resistance against pest and diseases. A essential package of nutrient management can be obtained through organic sources which is suitable and compatible for various crops based on scientific facts, local conditions and economic viability. There is significant role of foliar applied panchagavya in production of many plantation crops in India (Selvaraj, 2003). Panchagavya is a popular foliar nutrition prepared by organic growers as an indigenous material that used widely for agricultural and horticultural crops. Panchagavya contains several nutrients i.e. macronutrients like N, P, K and micronutrients which are required for the growth and development of plants and also contains various amino acids, vitamins, growth regulators like Auxins, Gibberellins and also beneficial microorganisms like pseudomonas, azatobacter and phosphor bacteria etc. In recent years, the good quality and safety 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 panchagavya 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 treatment i.e T_1-Control, T_2 - 2.5 ltr Panchagavya +2.5t/ha FYM, T_3 – 5 ltr Panchagavya+2.5t/ha Vermicompost, T_4 – 7.5 ltr Panchagavya+5t/ha FYM, T_5 – 10 ltr Pancahagavya+ 5t/ha Vermicompost, T_6– 2.5 ltr Fermented Buttermilk + 2.5t/ha FYM, T_7 – 5 ltr Fermented Buttermilk + 2.5t/ha Vermicompost, T_8 – 7.5 ltr Fermented Buttermilk + 5t/ha FYM, T_9 – 10 ltr Fermented Buttermilk + 5t/ha Vermicompost were evaluated. Data was analyzed for growth and yield attributing characters like plant height (cm), dry matter accumulation (m2), number of spikelets/spikes, 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).

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 grain/spike and test weught).

Plant Height

The data on plant height recorded at different growth stages are presented in table 4.1 and depicted in fig. 4.1 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 – 7.5 ltr panchaghavya + 5t/ha FYM (82.91), whereas, T1-control were recorded lowest plant height (72.39). Sureshkumar *et al.* (2011) [5] also recorded the same results. This might be due to application of panchagavya, that nitrogen was available throughout the life cycle of crop.

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

Treatments	Plant height (Harvesting)	Dry matter Accumulation (Harvesting)
T_1- Control	72.39	160.25
T_2 -2.5 ltr Panchagavya +2.5t/ha FYM	78.22	204.04
T_3- 5 ltr Panchagavya+2.5t/ha Vermicompost	78.45	205.12
T_4- 7.5 ltr Panchagavya+5t/ha FYM	82.91	210.69
T_5- 10 ltr Pancahagavya+ 5t/ha Vermicompost	80.45	206.46
T_6- 2.5ltr Fermented Buttermilk + 2.5t/ha FYM	78.78	206.28
T_7- 5 ltr Fermented Buttermilk + 2.5t/ha Vermicompost	78.36	205.55
T_8- 7.5ltr Fermented Buttermilk + 5t/ha FYM	80.97	207.36
T9-10 ltr Fermented Buttermilk + 5t/ha Vermicompost	78.82	206.31
CD (P=0.05)	1.64	2.49

Dry matter accumulation of plant (g/m^2)

The data pertaining to dry matter accumulation (g/m^2) at different growth stages as influenced by various treatments are presented in table 4.2 and depicted in figure 4.2. 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 at all the stages of growth and harvest, respectively followed by other treatments. Most dry matter (210.69) was produced by T_4 – 7.5 ltr panchaghavya + 5t/ha FYM at harvesting stage. The dry matter accumulation was recorded least in T_1 – Control (160.25). The overall similar results obtained by Choudhary *et al.* (2017) [4]. This could be due to the reason that application of panchaghavya and vermicompost improved the growth of crop.

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

Treatments	Length of spike(cm)	Number of grain/spike	Test weight (1000 seed/g)	Grain yield
T_1- Control	7.69	31.33	36.82	31.74
T_2 -2.5 ltr Panchagavya +2.5t/ha FYM	8.78	35.00	39.48	41.50
T_3- 5 ltr Panchagavya+2.5t/ha Vermicompost	9.02	35.33	39.41	42.14
T_4- 7.5 ltr Panchagavya+5t/ha FYM	10.42	39.33	42.63	42.95
T_5- 10 ltr Pancahagavya+ 5t/ha Vermicompost	9.36	35.00	40.21	45.57

T_{6}- 2.5ltr Fermented Buttermilk + 2.5t/ha FYM	8.86	35.67	38.05	40.56
T_{7}- 5 ltr Fermented Buttermilk + 2.5t/ha Vermicompost	8.52	33.67	38.16	42.23
T_{8}- 7.5ltr Fermented Buttermilk + 5t/ha FYM	9.61	37.33	40.35	40.55
T_{9}-10 ltr Fermented Buttermilk + 5t/ha Vermicompost	8.81	34.67	39.87	43.09
CD (P=0.05)	0.78	1.82	1.89	1.72

Length of spike (cm)

Critical analysis of data (table 2) revealed that length of spikes markedly increased with panchagavya and FYM application by various days. There is significant increase in length of spike (10.42 cm) with T_{4}– 7.5 ltr panchaghavya + 5t/ha FYM which is the highest and lowest in T1-control (7.69cm). These similar findings were also observed by Pagar *et al.* (2016).

Number of grain/spike

Data pertaining to number of grains/spike presented was significantly affected by treatment in Table 2 showed significant increase in grains per spike(39.33) with T_{4} – 7.5 ltr panchaghavya + 5t/ha FYM which was the highest and lowest (31.33) was recorded in T_{1} -control. These similar findings were also observed by Vimalendran *et al.* (2013) [3].

Test weight

The data pertaining to test weight is given in table 2. The data clearly showed that the T_{4} – 7.5 ltr panchaghavya + 5t/ha FYM resulted in significant increase in the test weight which was (42.63 g) and was lowest in T1-control (36.82 g). Similar results were obtained by Panchal *et al.* (2017).This could be due to the reason that application of panchagavya 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 are given in Table 2. A careful purview of data revealed that grain yield was significantly higher (47.53 q/ha) under T_{4} – 7.5 ltr panchaghavya + 5t/ha FYM then the other treatments. It was lowest in T1- control (18.19q/ha). Similar results were obtained by Kumar *et al.* (2011). This might be due to the reason that, panchagavya and vermicompost conatin more nitrogen concentration and improved the grain yield.

Conclusion

1. The best combination was found to be T_{4}- 7.5 ltr panchagavya + 5t/ha FYM with highest production potential in terms of wheat yield (115.56q/ha) under organic conditions.
2. Highest net returns of Rs 90087.75/ha and highest net returns per rupee invested (2.18) were obtained from T_{4}- 7.5 ltr Panchagavya + 5t/ha FYM

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