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Response of Wheat Varieties (*Triticum aestivum* L., var Darulaman-7 & Drukhshan-8) with FYM Application under Kandahar Semiarid Condition

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Abstract

A field experiment was conducted at the research farm of Agriculture Faculty, Kandahar University, Afghanistan, on Dec 2017 until May 2018 to study the effect of FYM on Bread wheat (*Triticum aestivum.* L.) two varieties such as Darulaman-7 (V) & Drukhshan-8 (V). The determinate experiment was laid out in the randomized complete block design (RCBD) with four levels of FYM (0, 8, 10 and 12 tons per hectare) in three replications. DAP fertilizer at 150. Kg (P_2O_5) ha^{-1} dose applied to all treatments equally. With the increase, in the use of FYM application, there was an important rise in wheat yield levels, as well as a significant change was seen between the two wheat varieties. Ultimately the FYM application offered a high dose as well as the recommendation to cultivate Drukhshan-08 variety.

Keywords: "FYM, Growth, Wheat Varieties (Darulaman-07, Drukhshan-08), Yield".

1. Introduction

Common soft, annual wheat (*Triticum aestivum* L. em Thell), the member of *Poaceae* family, is a self-pollinated winter crop, is one of the world's most important plant, dates back to ten-thousand years before stone age (Lev-Yadun *et al.* 2000). The global harvest in 2014 was 730 million tons, from 220 million hectares' land (FAOstat, 2016); however, the United States Department of Agriculture estimates, the World Wheat Production of 2019/2020 will be 764.39 million metric tons. As the population of the world is gradually increasing, the requirement for more food is correspondingly required. Nonetheless, comparing to the other countries of the world, Afghanistan average wheat yield is very low. As (FAO, 2019) data, with wheat production averaging 4809 thousand tons from 2013-2017, down to 4280 thousand tons in 2017, as well production reduced to 3500 thousand tons in 2018, a decrease of 18%. Wheat is the permanent food of the Afghanistan people.

The average wheat yield in irrigated land was 2.7 t ha^{-1}, when uses fertilizer wheat production increases to 3.5 t $ha^{-1}$and the average yield of saline area was 1.1 t ha^{-1} (Regional Food Survey, 2010).

Chemicals are widely used by farmers to obtain maximum yields per unit of land (Ahmad *et al.*, 2010). nevertheless, FYM and other chemical fertilizer has better effectiveness (Liu, *et al.*, 2010). Organic fertilizer application plays an important role in increasing soil fertility. Organics are the major substances, which are one of the most abundant and available matters of plants and animals. Since the organic matter obtained, is able to sustain agricultural productivity continuously (Singh and Agarwal, 2005). Organic manure usage increases the amount of organic carbon in the soil than other chemical fertilizers (Greorich *et al.*, 2001). To increase the soil fertility, adding animal manure to the soil, is a common practice (Griffin *et al.*, 2001). Crop growth development demonstrated with FYM application (Mehmood *et al.*, 1997). Response of Wheat in term of growth and yield to FYM application greater than 10 t ha^{-1} were remarkable and increased with adding-up in FYM up to the maximum of 30 Mg ha-1 FYM applications (Jan & Noor, 2007). Giving a combination of FYM, green manure, and straw residue, enhances their effectiveness. The combination of FYM with chemical fertilizers increases the yield, and the consumption of NPK elements in wheat (Muhammad Aatif *et al.*, 2017). Application of organic manure increases the nutrient use efficiency besides assists to decrease the environmental pollution. Usage of organic manure and organic waste, makes suitable situation for crop production (Sommerfeldt, *et al.*,1988). The illumination of above visions encouraged me to study the effect of farm yard manure application on growth and productivity of wheat for semi-arid region of Afghanistan.

2. Material and Method

A field experiment was conducted at the research farm of Agriculture Faculty, Kandahar University, Kandahar, Afghanistan at the beginning of winter 2016-17. The soil of the experimental field was sandy clay loam in texture with pH 8.25 and Electric Conductivity 0.36 (EC Mater). The content of NH_4-N and NO_3^-N (mg Kg^{-1}), available P and K (Kg ha^{-1}) were 10.25, 29.2, 20.96 and 100 respectively (by LaMotte Soil Test Kit). Total Organic Carbon (by TOC-VCPH) and total N (by Kjeldahl) was 19500 and 460 (mg/Kg) respectively. The experiment was laid out in randomized complete block design (RCBD) combined with three replications and 2.5m x 2.5 m plot geometry. Four levels of FYM treatments such as 0 (T1), 8 (T2), 10 (T3) and 12 (T4) t ha^{-1} was worked out with two wheat varieties such as Darulaman-07 (V1) and Drokhshan-08 (V2). However, 150 Kg ha^{-1} DAP (Diammonium-Phosphate) fertilizer was used on the sowing time to all plots equally, thus absolute control plots were not presented in the experiment. The growth observations and data were recorded from ten randomly selected plants in each plot. Plant height, leaf number $plant^{-1}$, as well leaf area with the dry weight of different plant parts were examined during different growth stages. Dried plant samples were weighted manually to evaluate growth analysis (RGR, NAR and LAR). The data from the number of tillers m^{-2}, number of spikes m^{-2}, number of spikelet $spike^{-1}$, number of grain $spike^{-1}$, 1000-grain weight, grain and straw yield were taken on physical maturity at the time of harvesting. The recorded biological production data from the samples of each plot was converted, and stated in t ha^{-1}. The grain and straw yield were determined by net area basis after removing the boundary rows.

3. Result and Discussion

Growth parameters such as, plant height (cm) and the number of leaves significantly increased by FYM application. Similar result was reported by Singh and Singh (2012). However, except control there was no significant difference in plants height and leaves number between the other treatments of FYM; this might be due to the minor change (2 tons) in FYM content among the treatments, as it was shown in Nigeria with the use of poultry manure (20 t ha^{-1}) in the growth of corn which was found to be the highest average for plant height and thickness (Akongwubel *et al.*, 2012). Relative growth rate (RGR) increased significantly from control plants to the highest dose of FYM application.

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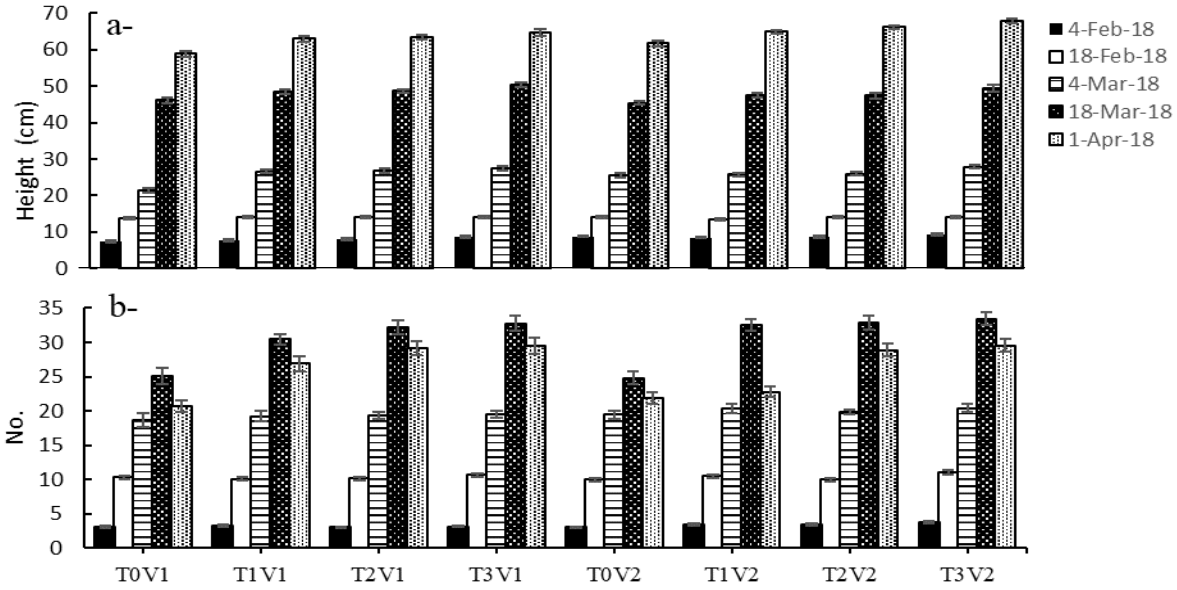

Figure 1. a- plant height (cm) and b- Leaf number of (V1) Darulaman-07 and (V2) Durokhshan-08, date wise for five different times observations.

Table 1. Growth analysis parameters such as RGR, and NAR (mg cm^2 d^{-1}), and LAR (cm^2 g^{-1}).

Variety	**RGR**	**NAR**	**LAR**
Darulaman-07 (V1)	33.956	1.425	24.071
Drukhshan-08 (V2)	34.901	1.41	24.926
SEm±	0.282	0.045	0.695
SE(d)	0.398	0.063	0.983
CD(P=0.05)	0.863	N/A	N/A
FYM tons ha^{-1}			
00	33.142	1.362	24.696
08	34.455	1.415	24.444
10	34.791	1.414	24.752
12	35.327	1.478	24.103
SEm±	0.398	0.063	0.983
SE(d)	0.563	0.089	1.39
CD(P=0.05)	1.22	N/A	N/A

RGR (Relative Growth Rate), NAR (Net Assimilation Rate), LAR (Leaf Area Ratio. SEm± (Standard Error of the Mean); SE(d) (standard error of the mean difference); CD (Critical difference).

The RGR (mg cm^2 d^{-1}) was significantly higher in the V2 (34.901) than V1 (33.956). The net assimilation rate (NAR) does not shown significant difference within the treatments, and shows the contrary relation with leaf area ratio (LAR). Although the LAR varies between the treatments and two varieties, it does not show any significant difference as shown in table (1). The root, shoot and a whole plant dry weight was importantly higher in V2 (2.01, 3.46 and 13.414 g/plant respectively) than V1 (2, 3.35, and 12.412 g/plant respectively). Moereover, by increasing the FYM levels in the treatments, progressive differences were seen in both vareities root's, shoot's, spike's and

whole plant dry weight than control, as shown in tabel (2), indicating the efficient use of avialable resources fore the plants. Has been shown, and because persistent of small amounts of the elements with excess water, may be the cause of their growth (Jagadeeswari & Kumaraswamy, 2000).

Table 2. Whole plants and their parts dry weight (g) and leaf area (cm^2).

Variety	leaf area	Root DW	Shoot DW	Spike Weight	Whole plant DW
Darulaman-07 (V1)	228.485	2	3.35	2.834	12.412
Drukhshan-08 (V2)	230.624	2.01	3.46	2.871	13.414
SEm±	2.878	0.02	0.04	0.121	0.226
SE(d)	4.069	0.02	0.05	0.171	0.319
CD(P=0.05)	N/A	0.02	0.112	N/A	0.691
FYM tons ha^{-1}					
00	202.176	1.92	3.01	2.353	10.468
08	229.037	2.01	3.32	2.727	12.721
10	239.048	2.03	3.56	2.979	13.673
12	247.95	2.05	3.73	3.352	14.789
SEm±	4.069	0.02	0.05	0.171	0.319
SE(d)	5.755	0.03	0.07	0.242	0.451
CD(P=0.05)	12.463	0.07	0.158	0.525	0.977

The number of tiller plant^{-1}, and number of Spikelet Spike^{-1} was significantly lower in V1 (4.275 and 2.492 plant^{-1} respectively) than V2 (4.75 and 2.542 plant^{-1} respectively). Additionally, increase in the number of spike is more relevant to the number of tiller plant^{-1}; as shown in Table (3), V2 has more tiller number than V1. Due to the increase in the FYM level, the growth in the number of tiller plant^{-1}, number of Spike Plant^{-1}, number of grain Spike^{-1} and the number of spikelet Spike^{-1} were noteworthy, as shown in Table (3). Similar result was obtained by Ibrahim *et al.*, (2008), who reported the significant increase in wheat growth, yield, number of tillers, length of spike, number of spikelet spike^{-1}, dry and fresh weight of the plant, and 1000 seed weight due to increasing in organic matter and compost in the soil.

Table 3. The effect FYM on average number of tiller and spike per plant then on grain and spikelet per spike; for two factors, varietal and treatment difference.

Variety	Tiller No. plant^{-1}	Spike No. Plant^{-1}	Grain No. Spike^{-1}	Spikelet No. Spike^{-1}
Darulaman-07 (V1)	4.275	2.492	43.333	17.483
Drukhshan-08 (V1)	4.75	2.542	43.383	17.733
SEm±	0.097	0.057	0.079	0.046
SE(d)	0.137	0.081	0.111	0.092
CD(P=0.05)	0.419	N/A	N/A	0.141
FYM tons ha^{-1}				
00	4.05	2.25	42.867	17.233
08	4.375	2.5	43.267	17.467
10	4.7	2.617	43.6	17.8
12	4.925	2.7	43.7	17.933
SEm±	0.137	0.081	0.111	0.065
SE(d)	0.193	0.115	0.158	0.131
CD(P=0.05)	0.593	0.248	0.341	0.2

Significant difference between two varieties was observed in the number of tiller and seed M^{-2}. V2 was superior than V1, in the number of tillers M^{-2} (689.58 and 614.45 respectively) and seed weight (g) M^{-2} (492.28 and 465.88 respectively) which result for increasing in maximum seed yield 5660.33 Kg ha^{-1} in V2 and 5419.65 Kg ha^{-1} in V1 with FYM application at 12 t ha^{-1}. FYM application significantly increased the number of tiller M^{-2}, number of spike M^{-2} and seed weight (g) M^{-2}, as shown in Table. (4). Kavinder, *et al.*, (2019), similarly found in their result that FYM application at 15 t h^{-1} combined with 120 kg of nitrogenous fertilizer, significantly increased wheat growth and yield. El-Naggar *et al*., (2012) from Egypt has been reported that FYM application up to 95.2 m^3 ha^{-1} increases the weight of spike's grain and seed yield in the wheat crop significantly. Singh & Singh, (2018), reported the maximum plant growth and remarkable increase in the number of tillers M^{-2} recorded with FYM (10 t ha^{-1}) application. The number of spike M^{-2} on V2 (368.96), correspondingly more than the number of spike M^{-2} in V1 (357.35). However, the current increase between two varieties for the number of spike M^{-2} was not significant as in Table 4.

Table 4. The effect FYM on average number of tiller, spike and seed weight (g) per squire mater; for two factors, varietal and treatment difference.

Variety	**Tillers No. M^{-2}**	**Spikes No. M^{-2}**	**Seed W (g) M^{-2}**
Darulaman-07 (V1)	614.45	357.35	465.88
Drukhshan-08 (V2)	689.583	368.967	492.28
SEm±	17.615	9.699	17.49
SE(d)	24.912	13.716	24.734
CD(P=0.05)	53.948	N/A	18.584
FYM tons ha^{-1}			
00	584.042	325.25	353.01
08	633.125	361.483	484.549
10	678.083	374.883	524.761
12	712.817	391.017	553.999
SEm±	24.912	13.716	24.734
SE(d)	35.23	19.398	34.98
CD(P=0.05)	76.294	42.007	75.751

Swarup & Yaduvanshi, (2000), reported a significant increase in the total weight of oven dried wheat plant in the response of organic matter and compost application compared to the control plants.
According to the Singh, Agrawal, & Singh, (2019), experiment, combine application of FYM and K_2O fertilizers on wheat, was found to increase plant height, number of tillers and spikes M^{-2}, length of spike, number of seed $spike^{-1}$, seed and straw yield ha^{-1}. The research of Singh and Agarwal, (2005) showed that with the combined use of 120 kg of nitrogen 25 kg of phosphorus and 10 tons of FYM ha^{-1}, beside attainment of the highest yields, large quantity of nitrogen, phosphorus and potassium was fixed to the soil.

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4. Conclusion

The application of FYM from low to high level (8, 10, and 12 t ha^{-1}) significantly improved wheat growth and yield attributes; maximum growth and yield was achieved, at high level of FYM (12 t ha^{-1}) application for both cultivars. It is notably proved that, Drukhshan-08 variety was better than Darulaman-07 as a whole.

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