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EFFECT OF ENHANCED N AND P FERTILIZER WITH CHICKEN MANURE ON GROWTH AND YIELD OF TOW WHEAT (Triticumaestivum L.) CULTIVARS AT NEW HALFA SCHEME

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ABSTRACT

A field experiment was conducted for two consecutive winter seasons (2017/2018 and 2018/2019) at Shebaik site of New Halfa Scheme. The experiment arranged in (RCBD) with three replications was designed to study the Effect of amended N and P fertilizers on Performance and yield of two wheat cultivars: Bohain (B) and Debera (D). The six fertilizers levels was designated as 0N0P, M, M1N, M2N, M1P and M2P, corresponding to control (0kg/ha), 4 ton of chicken manure without or with 43,86kgN/ha and 43,86kgP/ha, respectively. Characters studied included: (leaf area(cm^2) and shoot biomass(g) $plant^{-1}$, number of yielded tillers $plant^{-1}$, spike length, and grains $spike^{-1}$, grain yield (g)$plant^{-1}$,1000-grain weight(g, grain and harvest index.Generally, Debera cultivar (D) gave the heavier plants, highest number of tillers, longest spikes, higher number of grains $plant^{-1}$ and grain yield. The results showed that, application of chicken manure together with high N,P levels significantly increased all growth and yield attributes. The highest grains yield/ha (7615.7, 7615.6 kg/ha) were recorded due to sowing Debera and application of (M2N and M2P). Therefore, wheat cultivar Debera may be grown under the application of 86kg N or P with combination of chicken manure in the agro-ecological conditions of Shebiak at northern region of NewHalfa Scheme.

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INTRODUCTION

Wheat (*Triticumaestivum* L.), is a winter annual grain grass of the family Graminae, generally common to temperate zones grassland Prairies and Savannas (El-Ahmadi, 1994; Wall *et al*., 2006). Wheat, with its root ramifying into the depths of human culture, has an evolutionary history parallel to the history of human civilization itself. Even today, it decides the feast or famine for millions of people (Gowda *et al.*, 2008). Nitrogen and phosphorus are known to be essential nutrients for plant growth and development. The importance of nitrogen fertilization in increasing wheat yield production has been documented by many workers (Waraich *et al.,* 2002Abdelgadir *et al.,* 2010; Abedi*et al.,* 2011. Mubeen *et al.,* (2013). They concluded that increasing nitrogen rates increased total dry matter accumulation, grains yield per hectare. In wheat a positive effect of nitrogen fertilizer on 1000-grain weight was reported by many workers (Mattas *et al.,* 2011). Safer *et al.,* (1992) Abadi *et al*., (2012) concluded that the dry matter yield increased by addition of organic manure, especially when accompanied with urea.

Several growth parameters, including shoot biomass were gradually increased using P fertilizers (Ibtida, 2010; Balla *et al*, 2021). Also, other researchers (Abdelgadir *et al*., 2010)stated that, organic manures are a vital resource, not only for supplying plant nutrients, but also for improving soil physical and chemical properties.It acts as a slow-release fertilizer which provides nutrients over the whole growing season and often has a residual effect, which lasts for one or two further growing seasons (Harris, 2002). Sarwar *et al.,* (2007) concluded that, grain yield per unit area was significantly affected by application of nitrogen fertilizer along with organic manure than the sole application of synthetic fertilizers. Fertilizer P application significantly and positively influenced grain yield of wheat (Damene, 2003). Wheat production in New Halfa area (Eastern Sudan) is restricted by adverse soil physical properties and deficiency in some of plant nutrients (especially nitrogen and phosphorus). Adequate levels of nitrogen (N) fertilizer are needed**.** The problems associated with the single approach application of organic or inorganic fertilizers have made a combination of organic and inorganic fertilizers a realistic option in improving soil fertility and

productivity.Therefore, integrated use of chemical and organic fertilizer rate is needed to investigate in order to utilize the potential yield of improved wheat cultivars in the area.So, this study was aimed to determine the influence of fertilizers (N,P) with chicken manure on performance and yield of two wheat cultivars at Sabaat soil type.

MATREIALS AND METHODS

A field experiment was conducted for two consecutive winter seasons (2017/018 and 2018/019) at Shebaik site which located in the northern region of New Halfa Scheme.(Latitude 18°21′ N. Longitude35° 37′E and Altitude 450 m *asl*).The soil of the experimental site belongs to Sabaat series. The experiment was designed to study the Effect of amended N and P fertilizers on Performance and yield of two wheat cultivars: Bohain (B) early maturity and Debera (D) late maturity. The six fertilizers levels was designated as 0N0P, M, M1N, M2N, M1P and M2P, corresponding to control, 4 ton of chicken manure without or with 43,86kgN/ha and 43,86kgP/ha, respectively. The experiment was arranged in Randomized Complete Blocks Design (RCBD) with three replications in both seasons.Pre plant chicken manure applications were adjusted to account for residual soil nitrogen form found in pre plant soil samples taken at Shebaik site. The organic manure treatments were designated as –M and +M corresponding to zero and 4 tons of chicken manure/ha, respectively. The treated seeds (with insecticides, pesticides and fungicides) were sown at a rate of 120 kg/ha, in four lines 20 cm apart of each bed, on the third week of November in both seasons. Weeding was done manually and by using herbicides as needed. Irrigation was taken place as recommended.

Characters studied: Leaf area LA (cm), Shoot dry weight (g plant^{-1}), Number of yielded tillers plant^{-1},Spike length (cm), Number of grains spike^{-1},1000-grain weight (g) ,Grains yield (kg ha^{-1}) and Harvest index

Statistical analysis: Data was statistically analyzed according to the analysis of variance (ANOVA) for RCBD design, as combined of two seasons,using a computer software packages Statistics version 10. Mean comparisons was worked out by Duncan's Multiple Range Test (DMRT) at 5% level of probability.

RESULTS AND DISCUSSION

Increasing fertilizer levels resulted in significant increase in LA in both seasons (Table 1). In this regard, application of (M1P,M2N) treatments gave the highest LA values in both cultivars particularly in first season(table 1).Also, application of (M1P,M2N) treatments resulted in the heaviest shoot dry weight per plant as compared with its relative fertilizers treatments (Table 2). In this regard, application of (M2P) treatment with D cultivar significantly increased the mean shoot dry weight by more than 91% relative to control treatment with Bohain cultivar(table 2).The increase in growth characters (LA and dry matter)due to the addition of chicken manure with mineral N or P may be attributed to the fact that it supplies direct available nutrients (i.e., N) to the plants and improves soil physical properties particularly in heavy clay soils, as reported by (Harris 2002; Khan *et al*., (2010). Debera cultivar gave the highest number of tillers in both seasons (Table 4). Increasing fertilizer levels resulted in significant increase in mean number of yielded tillers plant^{-1}. In this regard, application of chicken manure (M) with 86 kg N/ha(M2N) and (M2P) treatments, particularly with Debera (Table 3).The longest spikes were observed in first season in Debera cultivar due to application of higher fertilizer levels. In this regard, application (M2N) and (M2P) treatments, particularly with Debera, significantly gave the longest spikesas compared to their relative treatments (Table 4). The positive effects combination of chicken manure with high levels of N or P on grain yield and yield components measured in this study could be attributed to the positive effects of these fertilizers on improving growth characters and consequently enhanced crop to produce more longer and number of spikes as reported by (Ahmed *et al*., 2017). The higher numbers of grains plant^{-1} were recorded in first season particularly with Debera cultivar (Table 5). application of manure with 43 and 86 kg of either N or P in Debera gave the higher numbers of grains plant^{-1} (more than 81 grains plant^{-1}) as compared with their relative treatments in first and second season, respectively (Table 4). The result was in line with the findings of Anwar (2016) who stated that, more grains spike^{-1} were counted at P rate of 90 kg P ha^{-1} and less number of grains spike^{-1} was recorded in control plots. In addition, spike length, thousand kernel weight and number of kernels per spike were significantly affected by phosphorus fertilizer application as reported by (Lakew, 2019). Sowing Debera cultivar was out-yielded Bohaincultivar particularly in the second season (Table 10). Increasing fertilization levels significantly resulted in a progressive increase in the mean grains yield per unit area. In this regard, application of chicken manure with 86 kg N/ha (M2N) treatment significantly increasedsignificantly increased mean grains yield by more than 103% relative to control treatment. Also, application of chicken manure with 86 kg P/ha (M2P) treatment significantly increased by more than 104.5% relative to control (table 6).The highest grains yield/ha (7615.7, 7615.6 kg/ha) were recorded due to sowing Debera and application of (M2N and M2P) treatments while the lowest grain yield/ha were observed when sowing Bohain without application of any fertilizer (table 6). SadurRehman and Khalil (2008) concluded that, application of organic manure with nitrogen increased grain yield by increasing dry matter production which resulted in highest grain weight. This may support the findings of this study where addition of high N level with organic manure resulted in a significant increase of yield and most of its components. Moreover, Adugna and Haile (2019) stated that, the highest grain yield was obtained from the combined applications of chemical N and compost than that obtained from N and compost applied alone.

Application of chicken manure (M) with 86 kg N/ha (M2N) and with 86 kg P/ha (M2P) treatments, particularly with Debera, significantly increased the1000-grain weight in both seasons (Table 9). Furthermore, the highest 1000-grain weight (45.36, 43.45 and 43.04 g) were recorded in M2N treatment in both seasons and due to M2P in first season, respectively (Table 7). Also, the higher HI values (35.27 and 37.78) was observed in plots where M2N and M2P treatments were applied as average of the two seasons (Table 8). Furthermore, sowing Debera cultivar under aforementioned treatments recorded the greater HI values as compared to Bohain cultivar under all fertilizer treatments in the both seasons (Table12). This may be due to increase in 1000-grain weight in these treatments. Similar positive responses of harvest index of wheat plant to N fertilization, organic manure and their combination were reported by Hussain *et al.,* (2002). On the other hand, Debera cultivar showed significant increase in the most growth parameters in this study. This might be attributed to the fact that, these traitsr mostly associated with the genetic makeup of the parental material of each cultivar.Also, the result is in agreement with the results demonstrated by (Bhutto *et al*., 2021) who reported that all the cultivars showed significantly varied performance for growth-related traits.The variability of tillers in cultivated cultivars in both years might be due to genetic variation in producing tillers, plant geometry, and changes in temperature in both seasons. The variation in spike length and number of grains per plant in all cultivars might have been associated with fluctuations in environmental conditions under both seasons. Present results are agreed with Slafer and Whitechurch (2001**)** who suggested that the spike length may be increased and decrease due to genetic variation during the reproductive stage of wheat. Furthermore, Bender *et al*. (1999) who suggested that the grains spike^{-1} was significantly influenced by various genotypes in different growing seasons. The Debera cultivar produced greater grain weight and consequently resulted in high 1000-grain weight. It was noticed that 1000-grain weight was higher in the second year. This might be due to better vegetative growth of the wheat plants that leads to more production of tillers, resultantly more seeds with higher weight were produced. The same results have been documented by Singh *et al*. (2002) they suggested that the performance of various wheat genotypes was significantly ($P < 0.05$) performed for 1000-grain weight (g) under different growing seasons.

Table 1. Mean of leaf area (LA) as affected by amended N and P fertilizers on performance and yield of two wheat cultivars during 2016/2017 and 2017/2018 seasons

Treatments	B	D	means	ONOP	M 0N0P	M 1N	M 2N		M 1P		M 2P	
S1	231.65	304.82	218.23	184.63	165.25	212.95	247.87		243.44		255.26	
S2	221.80	203.15	211.40	172..04	189.34	209.23	258.06		220.65		22.55	
Mean	226.73	203.99		178.33	177.29	211.09	252.97		232.04		240.40	
$LSD_{0.05}$	S= 7.97ctvr = 7.97Sxctvr = 11.27 fertilizer = 13.80 Sx fertilizer= 19.52											
	B ONOP	B M 0N0P	BM 1N	BM 2N	BM1P	BM2P	DONOP	D M 0N0P	DM 1N	DM 2N	DM1P	DM2P
S1	192.39	201.00	232.28	254.02	247.77	262.42	176.86	129.49	193.43	241.73	239.11	248.90
S2	177.22	209.19	228.17	284.39	212.20	219.67	166.80	169.49	190.30	231.73	229.11	231.43
Mean	184.81	205.09	230.22	269.20	229.98	241.08	171.86	149.49	191.96	236.73	234.11	239.76
$LSD_{0.05}$	ctvr x fertilizer = 19.52 Sxctvr x fertilizer=27.60											

S≡ season factor, ctvr≡ cultivar factor, fertilizer≡ fertilization factor,
$LSD_{0.05}$≡ Least significant difference at 5% probability
S1≡ first season, S2 ≡ second season
B≡ Bohaincultivar, D≡ Debera cultivar
0N0P≡ control, M≡ 4 tons manure/ha, M1N ≡ 4ton manure+43 kg N/ha, M2N≡4ton manure+86 kg N/ha,
M1P≡ 4ton manure+43 kg P/ha and M2P≡4ton manure+86 kg P/h

Table 2. Mean of shoot dry weight (g) as affected by amended N and P fertilizers on performance and yield of two wheat cultivars during 2016/2017 and 2017/2018 seasons

Treatments	B	D	means	ONOP	M 0N0P	M 1N	M 2N		M 1P		M 2P	
S1	6.38	7.28	6.83	3.35	6.80	9.35	6.81		6.73		7.45	
S2	6.36	5.85	6.09	4.08	5.22	6.39	8.07		6.00		6.90	
Mean	6.37	6.57		3.72	6.01	7.87	7.44		6.37		7.18	
$LSD_{0.05}$	S= 0.98 ctvr = 0.98Sxctvr = 1.69 fertilizer = 1.38 Sx fertilizer= 2.39											
	B ONOP	B M 0N0P	BM 1N	BM 2N	BM1P	BM2P	DONOP	D M 0N0P	DM 1N	DM 2N	DM1P	DM2P
S1	2.79	6.30	9.73	6.35	6.89	6.22	3.90	7.29	9.96	7.20	6.57	8.68
S2	5.40	5.31	6.60	9.33	6.42	6.96	4.59	5.10	6.18	6.78	5.58	6.84
Mean	4.09	5.81	8.17	7.84	6.66	6.59	4.25	6.20	8.07	6.99	6.08	7.76
$LSD_{0.05}$	ctvr x fertilizer = 2.39 Sxctvr x fertilizer= 3.38											

Table 3. Mean of number of yielded tillers per plant as affected by amended N and P fertilizers on performance and yield of two wheat cultivars during 2016/2017 and 2017/2018 seasons

Treatments	B	D	means	ONOP	M 0N0P	M 1N	M 2N		M 1P		M 2P	
S1	6.41	6.40	6.41	4.43	5.33	6.23	7.32		7.03		7.93	
S2	2.56	7.89	5.23	3.57	4.90	5.33	5.67		5.35		6.13	
Mean	4.49	7.14		4.00	5.19	5.78	6.49		6.39		7.03	
$LSD_{0.05}$	S= 0.94 ctvr = 1.63 Sxctvr = 1.63 fertilizer = 2.31 Sx fertilizer= 0.42											
	B ONOP	B M 0N0P	BM 1N	BM 2N	BM1P	BM2P	DONOP	D M 0N0P	DM 1N	DM 2N	DM1P	DM2P
S1	3.92	5.33	6.47	7.80	7.10	7.33	4.93	5.63	6.00	6.33	6.97	8.03
S2	3.33	2.60	2.47	3.67	2.50	2.30	2.30	7.00	8.20	8.37	9.00	9.47
Mean	3.13	3.97	4.46	5.32	4.50	5.32	5.32	6.42	7.10	7.75	7.98	
$LSD_{0.05}$	ctvr x fertilizer = 0.42 Sxctvr x fertilizer=0.53											

Table 4. Mean of spike length (cm) as affected by amended N and P fertilizers on performance and yield of two wheat cultivars during 2016/2017 and 2017/2018 seasons

Treatments	B	D	means	ONOP	M 0N0P	M 1N	M 2N		M 1P		M 2P	
S1	6.12	8.14	7.13	6.08	6.85	7.17	7.58		7.43		7.67	
S2	46ز5	7.53	6.49	6.58	5.88	6.55	7.23		6.50		7.12	
Mean	79ز5	7.84		5.88	6.37	6.85	7.41		6.97		7.39	
$LSD_{0.05}$	S= - ctvr = - Sxctvr = 0.31 fertilizer = 0.51 Sx fertilizer= 0.50											
	B ONOP	B M 0N0P	BM 1N	BM 2N	BM1P	BM2P	DONOP	D M 0N0P	DM 1N	DM 2N	DM1P	DM2P
S1	5.43	6.20	6.53	6.55	6.53	6.55	6.73	7.70	8.13	8.63	8.87	8.80
S2	4.27	5.83	5.33	5.53	6.10	6.10	7.10	7.57	7.27	8.13	7.47	8.13
Mean	4.85	6.52	6.43	5.77	6.32		6.92	7.83	7.70	8.38	8.17	8.47
$LSD_{0.05}$	ctvr x fertilizer = - Sxctvr x fertilizer= 1.88											

Table 5. Mean of number of grains/plant as affected by amended N and P fertilizers on performance and yield of two wheat cultivars during 2016/2017 and 2017/2018 seasons

Treatments	B	D	means	ONOP	M 0N0P	M 1N	M 2N		M 1P		M 2P	
S1	43.83	80.85	62.34	55.43	61.82	63.78	64.48		61.68		66.83	
S2	46.78	64.70	55.74	46.07	53.13	53.53	59.67		56.23		65.80	
Mean	45.31	72.78		50.73	57.43	58.65	62.07		58.96		66.31	
$LSD_{0.05}$	S=2.18 ctvr = 2.14 Sxctvr = - fertilizer = 70 Sx fertilizer= 3.64											
	B ONOP	B M 0N0P	BM 1N	BM 2N	BM1P	BM2P	DONOP	D M 0N0P	DM 1N	DM 2N	DM1P	DM2P
S1	33.97	42.53	46.05	45.95	42.87	52.63	77.00	81.10	81.50	83.00	81.50	81.00
S2	36.13	46.13	80ز50	51.73	43.20	52.67	56.00	60.73	56.27	67.60	69.27	78.93
Mean	35.05	44.33	48.43	48.54	42.53	52.65	66.50	66.50	65.88	75.35	75.38	79.97
$LSD_{0.05}$	ctvr x fertilizer = 5.24 Sxctvr x fertilizer=7.41											

Table 6. Mean of grains yield (kg/ha) as affected by amended N and P fertilizers on performance and yield of two wheat cultivars during 2016/2017 and 2017/2018 seasons

Treatments	B	D	means	ONOP	M 0N0P	M 1N	M 2N		M 1P		M 2P	
S1	3311.5	6317.7	4814.6	3146.8	3951.8	4816.7	5779.8		5293.0		5899.3	
S2	3829.4	6254.4	5041.9	2845.0	4750..8	4540.8	6386.7		5376.7		6351.7	
Mean	3570.5	6286.1		2995.9	4351.3	4678.8	6083.3		5334.8		6125.5	
$LSD_{0.05}$	S= 0.91 ctvr = 1.57 Sxctvr = 1.28 fertilizer = 22.22 Sx fertilizer= 222.2											
	B ONOP	B M 0N0P	BM 1N	BM 2N	BM1P	BM2P	DONOP	D M 0N0P	DM 1N	DM 2N	DM1P	DM2P
S1	1791.7	2749.7	3130.7	4014.3	3905.3	4277.3	4502.0	5154.0	6502.0	7545.3	6680.7	7521.3
S2	3260.0	3385.0	3288.3	4925.0	4015.0	4993.3	3330.0	6106.7	5793.3	7848.3	6738.3	7710.0
Mean	2075.8	3072.3	3209.5	4469.7	3960.2	4635.3	3916.0	5630.3	6148.0	7615.7	6709.5	6ز7615
$LSD_{0.05}$	ctvr x fertilizer = 339.51 Sxctvr x fertilizer=480.14											

Table 7. Mean of 1000-grain weight (g) as affected by amended N and P fertilizers on performance and yield of two wheat cultivars during 2016/2017 and 2017/2018 seasons

Treatments	B	D	means	ONOP	M 0N0P	M 1N	M 2N		M 1P		M 2P	
S1	36.65	41.38	39.07	35.71	41.80	38.86	42.95		35.60		40.54	
S2	42.09	39.48	40.79	35.80	38.35	40.40	46.86		39.53		43.80	
Mean	39.37	40.48		35.76	39.76	39.63	44.91		37.35		42.17	
$LSD_{0.05}$	S= 2.35	ctvr = 4.38		Sxctvr = 9.38		fertilizer = 6.20		Sx fertilizer= 0.67				
	B ONOP	B M 0N0P	BM 1N	BM 2N	BM1P	BM2P	DONOP	D M 0N0P	DM 1N	DM 2N	DM1P	DM2P
S1	33.71	38.68	36.36	40.45	32.66	38.04	37.71	43.68	41.36	45.45	36.66	43.04
S2	35.90	35.00	41.43	40.27	43.40	46.57	35.71	41.68	39.36	43.45	35.66	41.04
Mean	34.81	39.84	38.90	40.36	38.03	42.30	36.71	42.68	40.36	44.35	36.66	42.04
$LSD_{0.05}$	ctvr x fertilizer = 0.67			Sxctvr x fertilizer= 1.16								

Table 8. Mean of harvest index (HI)as affected by amended N and P fertilizers on performance and yield of two wheat cultivars during 2016/2017 and 2017/2018 seasons

Treatments	B	D	means	ONOP	M 0N0P	M 1N	M 2N		M 1P		M 2P	
S1	28.14	29.60	28.87	24.30	28.75	27.93	31.39		28.30		32.65	
S2	31.29	40.21	35.75	29.45	31.36	34.46	39.16		37.16		42.92	
Mean	29.72	34.90		26.83	30.05	31.19	35.27		32.00		37.78	
$LSD_{0.05}$	S= 1.88	ctvr = 3.26		Sxctvr =-		fertilizer = 3.36		Sx fertilizer= 4.61				
	B ONOP	B M 0N0P	BM 1N	BM 2N	BM1P	BM2P	DONOP	D M 0N0P	DM 1N	DM 2N	DM1P	DM2P
S1	25.34	30.12	26.38	28.60	26.86	31.00	22.77	27.37	29.47	34.17	29.53	37.78
S2	26.76	28.51	29.26	33.01	34.85	35.01	32.15	34.17	39.30	43.3`	39.84	45.30
Mean	29.36	29.32	28.00	30.81	30.85	33.01	27.40	30.77	34.39	39.74	34.68	41.54
$LSD_{0.05}$	ctvr x fertilizer = 6.52			Sxctvr x fertilizer=0.91								

Thus the increase in the yields components in Deberacultivar could be the reason for its superior to the grain yield. Ahmed *et al* (2017) also reported the same results regarding grain yield (kg ha^{-1}) of wheat cultivars. Based on the findings of the current study, it could be concluded that, under application of 86kg N or P with combination of chicken manure (4 ton/ha),wheat cultivar Debera performed better in terms of growth, yield, and yield characters as compared to Bohain cultivar in both years. Therefore, wheat cultivars Debera may be grown under the agro-ecological conditions of Shebiak at northern region of New Halfa Scheme.

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