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EFFECT OF SEED RATE AND CULTIVAR ON PRODUCTIVITY OF WHEAT (*Triticum aestivum L.*) IN NEW HALFA LOCALITY, SUDAN

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ABSTRACT

An experiment was conducted for two winter seasons during 2016/017 - 2017/018 at the Experimental Farm of the Faculty of Agriculture, University of Kassala (New Halfa), Sudan to investigate the effect of seed rate and Variety of wheat (Triticum aestivum L.) on grain productivity under New Halfa environment. The treatments consisted of three seed rates (119kg/ ha, 143kg/ ha and 167kg/ ha) and two cultivars (Condor (early mature) and Bohin (medium mature). A complete randomized block design (CRBD) with four replications was used. The results revealed that the lesser seed rate (119 kg/ ha) had a lower grain yield compared with the mid seed rates (143kg ha-1) or highest seed rate (167kgha-1). Cultivars had significant differences in the total seed yield. Condor gave the highest seed yield. It could be concluded that the seed rate of 143 kg or 167 kg/ha recommended to improved seed yield in New Halfa area of Sudan.

Contribution/Originality: This study is one of the very few studies which have investigated the effect of seed rate and Variety of wheat (*Triticum aestivum* L.) on seed yield under New Halfa environment, Sudan.

1. INTRODUCTION

Wheat crop (*Triticum aestivum* L.), is one of the most important cereal crops. Its stable food for one-third of the *world's* population [1]. Wheat is a member of the family Germaine [2]; [3]. It is grown almost in all countries [4] constituting 15.4% of the world's arable land. The main wheat regions of the world lie between latitude 30° to 55° in the northern temperate zone and 25° to 40° in the southern temperate zone [5].

During the last three production seasons (2015-2018), the average world wheat areas were about 224.7 million hectares producing 689.1 million metric tons with an average yield estimated at 3.08 tons per hectare [6]. This explains the urgent need to raise yield by cultivation of high yielding and adapted varieties in low yielding wheat areas as well as improving cultural practices.

Among the agricultural technique of wheat, plant density has been used successfully to increased grain yield and quality [7]. Efforts are now in Sudan to encourage the cultivation of bread wheat to meet the domestic need and export. Cultivars (yield stability) emerges as a serious threat to low productivity of wheat. It was imperative to conduct an experiment involving different wheat cultivars with regard to its response to low and high planting densities, to obtain the potential grain yield of these cultivars. The objective of this study is to investigate the effect of cultivar and seed rate on yield of bread wheat (*Triticum aestivum* L).

2. MATERIALS AND METHODS

The field experiment was conducted for two seasons (2016/017 - 2017/018), at Experimental Farm of the Faculty of Agriculture and Natural Resources, Halfa al gadidah , Sudan, Latitude 15° 19' N., Longitude 35° 36' E and Altitude 450 m asl.

The soil of the experimental site belongs to khashm ElGirba Series, classified as sodic Haplusters, very fine smectitic, isohyperthermic with a clay percentage around 60 % and pH in the range of 4.8 to 8.8 [8]. The climate of the locality is semi-arid (rainy season from June to September) with mean day temperature around 23°C and 15.7°C during summer and winter, respectively. The experimental site was ploughed in July and September using wide level disc, harrowed and ridged. The cultivars were sown on ridges with 80cm apart. Seeds were sown manually at a rate of 119, 143, and 167 kg/ ha. The aim of this experiment is to study the effect of seed rate on yield of two wheat cultivars namely Condor and Bohin. The experiment arranged in a complete randomized block design (CRBD) with four replications. The treatments were: Two varieties Condor, bohin were grown at three planting densities, (119kg/ ha, 143kg /ha and 167kg .ha) designated as SR_1, SR_2 and SR_3, respectively. The gross plot size was 6 x 6.5 m^2 and sowing date was 15 November. Two to three times hand weeding was used by traditional tools as Torya and hand picking, plant was irrigated every 14 days. Nitrogen fertilizer (46% nitrogen) applied at a rate of 84 kg per hectare. Harvesting was carried out when the ears became yellow in color.

The following data were obtained from 10 plants, randomly selected from one meter square of the inner two rows of each plot: the number of spikes per panicle, main stem, length of spike (cm), number of seeds per spike, 1000-grain weight (g) and grain yield (kg/ha).

2.1. Statistical Analysis

Data statistically analyzed according to the Gomez and Gomez [9]. Using Mstat-C computer software package [10]. Analysis of variance of all studied traits was determined. For mean comparison, Duncan's Multiple Range Test (DMRT) at 5% probability level was used.

3. RESULTS AND DISCUSSION

Spike length significant differences were reported among the seed rates and interaction, no significant differences among the cultivars in the two seasons Table 1.

Table-1. Mean spike length in cm for the two wheat (*Triticum aestivum*) cultivars grown at three seed rates, in faculty of Agriculture Farm, New Halfa in winter season 2015/2016 and 2016/2017.

Season 2015/2016				
Seed Rate Cultivar	**SR1**	**SR2**	**SR3**	**Means**
Condor	12.48	11.98	11.99	12.15
Bohin	12.48	11.78	11.80	12.02
Means	12.48[a]	11.88[b]	11.90[b]	
LSD $_{0.05}$ SR	0.53			
LSD $_{0.05}$ C	0.43			
LSD $_{0.05}$ C × SR	0.74			
Season 22016/2017				
Condor	11.13[a]	10.45[b]	10.55[b]	10.71
Bohin	10.68[ab]	11.15[a]	10.48[b]	10.77
Means	10.90	10.80	10.51	
LSD $_{0.05}$ SR	0.38			
LSD $_{0.05}$ C	0.31			
LSD $_{0.05}$ C × SR	0.54			

Values within the row having different letters are significantly different. Bold, italic and normal letters denote for seed rates cultivars and interaction, respectively using DMRT at 0.05 level of probability.

Significant differences in spike length, which were observed in seed rate in season one and in interaction in season two, while the two varieties insignificant effect on spike length. However, longer spike length recorded in the low seed rate (SR_1) and the shorter length in high density. This is in-line with the findings of Abbas, et al. [11] and Suleiman [12]. They find a decreasing trend in spike length in both increasing and decreasing direction. Nizamani, et al. [13] and Ozturk, et al. [14] reported that spike production per plant increased with reducing the pattern of seed rate.

Differences in the number of grains per spike varied from 26.80 to 32.13 and 36.38 to 37.00 in season one and two, respectively Table 2. The significant differences among seed rate, cultivars and their interaction in season one were recorded. The SR_1 (119kg) recorded the highest grains per spike in the two-season while the SR_3 recorded the lowest number in both seasons. Also condor variety recorded the lowest number of grain compare with bohin variety. In contrast, there was no significant differences in the second season.

Table-2. Means number of grain/spike for the two wheat cultivars (*Triticum aestivum* L) grown at three seed rates in faculty of Agriculture Farm, New Halfa in season 2015/2016 and 2016/2017.

Season 2015/2016				
Seed Rate Cultivar	**SR1**	**SR2**	**SR3**	**Means**
Condor	32.13^{a}	29.93^{b}	26.80^{c}	29.62^{b}
Bohin	31.32^{a}	29.00^{b}	31.30^{a}	30.54^{a}
Means	31.73^{a}	29.46^{b}	29.05^{b}	
LSD $_{0.05}$ SR	0.94			
LSD $_{0.05}$ C	0.77			
LSD $_{0.05}$ C × SR	1.34			
Season 22016/2017				
Condor	37.00	36.38	36.73	36.70
Bohin	37.38	37.15	36.73	37.08
Means	37.19	36.76	36.73	
LSD $_{0.05}$ SR	1.32			
LSD $_{0.05}$ C	1.08			
LSD $_{0.05}$ C × SR	1.87			

Values within the row having different letters are significantly different. Bold, italic and normal letters denote for seed rates cultivars and interaction, respectively using DMRT at 0.05 level of probability.

Significant differences among treatments in the number of grains per spike were observed. The low seed rate recorded the highest number of grains, while the high seed rate recorded the lowest number of grains. Iqbal, et al. [15] reported that the highest grains per spike resulted in the low density. However, Muhammad, et al. [16] and Malik, et al. [17] found that the seed rate had no effect the grains number per spike.

Cultivar Bohin recorded the highest grains per spike. Similar findings observed by Mali and Choudhary [18]. In contrast, Saeed, et al. [19] finding that insignificant effect between varieties on number of grains per spike. Also Pandey, et al. [20] recorded that population non-significant effects on number of grains per spike, kernel weight, spike weight, and 1000-seed weight of wheat.

The seed rates significantly affect 1000-grain weight Table 3. The maximum 1000-grain weight was obtained under the highest seed rate (167kg). Between cultivar condor recorded the highest weight of 1000 seed weight compare with Bohin cultivar. The results showed that 1000-grain weight reduced with increasing seed rate. This might be due to plant competition. These in agree with Shahzad, et al. [21] and Baloch, et al. [22].

The treatment statistically significant difference in grain yield Table 4. The seed rate 167 kg/ ha produced the highest grain yield. The lesser grain yield was obtained from 119 kg/ha. This finding is in line with the finding of Baloch, et al. [22] decreased the yield of wheat with increasing seed rate. Similar finding stated by Hayatullah, et al. [23] increased yield of wheat with increasing seed rate. Tompkins, et al. [24] mentioned that the increase in seed rate increased grain yield. Naseem, et al. [25] and Thakur, et al. [26] found that wheat was quite responsive to

increased seed rate, the highest seed rate produced greater plant population m^{-2}. Also Hameed, et al. [27] stated that grain yield increased as seed rate increased.

Table-3. Means 1000-seed weight (g) for the two wheat cultivars (*Triticum aestivum* L) grown at three seed rates in faculty of Agriculture Farm, New Halfa in season 2015/2016 and 2016/2017.

Season 2015/2016				
Seed Rate Cultivar	**SR1**	**SR2**	**SR3**	**Means**
Condor	37.04^{ab}	38.29^{a}	35.35^{c}	36.89^{a}
Bohin	36.02^{bc}	35.67^{c}	35.27^{c}	35.65^{b}
Means	35.53^{a}	36.98^{a}	35.31^{b}	
LSD $_{0.05}$ SR	0.90			
LSD $_{0.05}$ C	0.74			
LSD $_{0.05}$ C × SR	1.28			
Season 22016/2017				
Condor	34.38^{b}	35.43^{a}	36.10^{a}	35.30^{a}
Bohin	35.98^{a}	35.93^{a}	33.80^{b}	35.23^{a}
Means	35.18^{a}	35.68^{a}	34.95^{a}	
LSD $_{0.05}$ SR	0.73			
LSD $_{0.05}$ C	0.59			
LSD $_{0.05}$ C × SR	1.03			

Values within the row having different letters are significantly different. Bold, italic and normal letters denote for seed rates cultivars and interaction, respectively using DMRT at 0.05 level of probability.

Table-4. Means of Yield (kg/ha) for the two wheat cultivars (*Triticum aestivum* L) grown at three seed rates in faculty of Agriculture Farm, New Halfa in season 2015/2016 and 2016/2017.

Season 2015/2016				
Seed Rate Cultivar	**SR1**	**SR2**	**SR3**	**Means**
Condor	3700^{ab}	3800^{a}	$3600A^{b}$	3700^{a}
Bohin	2825^{d}	3300^{c}	3575^{b}	3233^{b}
Means	3262^{b}	3550^{a}	3587^{a}	
LSD $_{0.05}$ SR	146.9			
LSD $_{0.05}$ C	119.9			
LSD $_{0.05}$ C × SR	207.7			
Season 22016/2017				
Condor	2189^{b}	2094^{b}	3041^{a}	2523^{a}
Bohin	2229^{b}	2299^{b}	2222^{b}	2194^{b}
Means	2196^{b}	2209^{b}	2671^{a}	
LSD $_{0.05}$ SR	136			
LSD $_{0.05}$ C	111			
LSD $_{0.05}$ C × SR	192			

Values within the row having different letters are significantly different. Bold, italic and normal letters denote for seed rates cultivars and interaction, respectively using DMRT at 0.05 level of probability.

4. CONCLUSION

From the results obtained, it can be concluded that the Sowing wheat cultivar, Condor or Bohin on seed rates of 143 kg or 167 kg/ ha improved the wheat productivity in New Halfa locality of Eastern Sudan.

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REFERENCES

[1] M. I. Hussein and S. H. Shah, "Growth, yield and quality response of three wheat (Triticum aestivum L.) varieties to different levels of N, P and K," *International Journal of Agriculture and Biology*, vol. 4, pp. 362-364, 2002.

[2] E. E. M., A. M. El Naim, M. K. Abdelrhaman, and A. A. Ishag, "Effect of sowing date and cultivar on seed yield of wheat (Triticum aestivum L.) in new Halfa Eastern Sudan," *International Journal of Research Studies in Agricultural Sciences*, vol. 4, pp. 34-39 2018.

[3] G. Wall, R. Garcia, B. Kimball, D. Hunsaker, P. Pinter, S. P. Long, C. Osborne, D. Hendrix, F. Wechsung, and G. Wechsung, "Interactive effects of elevated carbon dioxide and drought on wheat," *Agronomy Journal*, vol. 98, pp. 354-381, 2006. Available at: https://doi.org/10.2134/agronj2004.0089.

[4] R. Singh and R. Trethowan, *Breeding spring bread wheat for irrigated and rain fed production systems of the developing world. In: Kang M, Priyadarshan PM Breeding major food staples.* New York: Blackwell Publishing: John Wiley and Sons. Inc, 2007.

[5] T. D. Teare and M. M. Peet, *Crop water relations, wheat and Sugarcane. Tilly L. and L. Chapman. 1999. Benchmarking crop water index for Queensland sugar industry.* The United Nations: Tilly and Chapman, 1983.

[6] OECD-FAO, "OECD-FAO agricultural outlook 2018-2027, OECD Publishing, Paris/Food and AgricultureOrganization of the United Nations, Rome. Available: https://doi.org/10.1787/agr_outlook-2018-en," 2018.

[7] V. Sardana, S. Sharma, and A. Randhawa, "Performance of wheat (Triticum aestivum) varieties under different sowing dates and nitrogen levels in the submontane region of Punjab," *Indian Journal of Agronomy*, vol. 47, pp. 372-377, 2002.

[8] Z. A. Ali, "The effect of three organic manures on the properties of Khashm Elgirba soil series and yield of wheat," Ph.D Thesis, University of Gezira, Sudan, 2001.

[9] K. Gomez and A. A. Gomez, *Statistical procedures for agricultural research*, 4th ed. New York: John Wiley and Sons. Inc, 1984.

[10] G. Nelsen, *Microsoft program for design, management and analysis of agronomy research experiment.* USA: Michigan State University, 1992.

[11] G. Abbas, M. Ali, M. Azam, and I. Hussain, "Impact of planting methods on wheat grain yield and yield contributing parameters," *Journal of Animal and Plant Sciences*, vol. 19, pp. 30-33, 2009.

[12] S. A. Suleiman, "The influence of triticum asetivum seeding rates and sowing patterns on the vegetative characteristics in Shambat soil under irrigation," *Research Journal of Agriculture and Biological Sciences*, vol. 6, pp. 93-102, 2010.

[13] G. Nizamani, A. Imtiaz, A. Khatri, M. Siddiqui, M. Nizamani, and M. Khaskheli, "Influence of different row spacing on agronomic traits in different wheat varieties," *International Journal of Development Research*, vol. 4, pp. 2207-2211, 2014.

[14] A. Ozturk, O. Caglar, and S. Bulut, "Growth and yield response of facultative wheat to winter sowing, freezing sowing and spring sowing at different seeding rates," *Journal of Agronomy and Crop Science*, vol. 192, pp. 10-16, 2006. Available at: https://doi.org/10.1111/j.1439-037x.2006.00187.x.

[15] N. Iqbal, N. Akbar, M. Ali, M. Sattar, and L. Ali, "Effect of seed rate and row spacing on yield and yield components of wheat (Triticum aestivum L.)," *Journal of Agricultural Research*, vol. 48, pp. 151-156, 2010.

[16] A. Muhammad, C. G. Rabbani, G. M. Subhani, and I. Khaliq, "Combinig ability studies for some polygenic traits in aestivium species," *Pakistan Journal of Biological Sciences*, vol. 2, pp. 434-437, 1999. Available at: https://doi.org/10.3923/pjbs.1999.434.437.

[17] M. A. Malik, M. H. Rasheed, and A. Razzaq, "Row spacing study on two wheat varieties under rainfed conditions," *Sarhad Journal of Agriculture*, vol. 12, pp. 31-36, 1996.

[18] H. Mali and J. Choudhary, "Performance of bread wheat (Triticum aestivum L.) varieties under different row spacing," *Journal of Wheat*, vol. 4, pp. 55-57, 2011.

[19] B. Saeed, G. Hasina, A. Shazma, K. Ayub, A. Shamsher, and N. Ishrat, "Performance of wheat varieties sown under solid and skip row geometry," *Journal of Agricultural and Biological Science*, vol. 7, pp. 545-548, 2012.

[20] B. P. Pandey, K. B. Basnet, M. R. Bhatta, S. K. Sah, R. B. Thapa, and T. P. Kandel, "Effect of row spacing and direction of sowing on yield and yield attributing characters of wheat cultivated in Western Chitwan, Nepal," *Agricultural Sciences*, vol. 4, pp. 309-316, 2013. Available at: https://doi.org/10.4236/as.2013.47044.

[21] M. Shahzad, Wasi-ud-Din, S. Sahi, M. Khan, M. Ehsanullah, and M. Ahmad, "Effect of sowing dates and seed treatment on grain yield and quality of wheat," *Pakistan Journal of Agricultural Sciences*, vol. 44, pp. 581-583, 2007.

[22] M. Baloch, I. Shah, M. Nadim, M. Khan, and A. Khakwani, "Effect of seeding density and planting time on growth and yield attributes of wheat," *The Journal of Animal and Plant Sciences*, vol. 20, pp. 239-240, 2010.

[23] K. Hayatullah, A. Muhammad, H. Iqtidar, Z. Muhamad, and K. Masood, "Effects of sowing methods and seed rates on grain yield and yield components of wheat variety pak-8," *Pakistan Journal of Biological Sciences*, vol. 3, pp. 1177-1179, 2000. Available at: https://doi.org/10.3923/pjbs.2000.1177.1179.

[24] D. K. Tompkins, G. E. Hultgjreen, A. T. Wright, and D. B. Fowler, "Seed rate and row spacing of no- till winter wheat," *Agronomy Journal*, vol. 83, pp. 684-688, 1991. Available at: https://doi.org/10.2134/agronj1991.00021962008300040022x.

[25] K. Naseem, A. R. H. Qureshi, J. a. Akhtar, and M. A. Masood, "Screening of wheat (Triticum aestivum L.) genotypes against salinity in solution culture," *Pakistan Journal of Agricultural Sciences*, vol. 37, pp. 1-6, 2002.

[26] S. S. Thakur, I. S. Pandev, S. J. Singh, and Mishr, "Effect of seed rate and row spacing on late sown wheat in alluvial calcareous soil," *Journal of Research Birsa Agriculture University*, vol. 2, pp. 123-125, 1996.

[27] E. Hameed, S. A. Wajid, A. A. Shad, J. Bakht, and T. Muhammad, "Effect of different planting dates, seed rates and nitrogen levels on wheat," *Asian Journal of Plant Sciences*, vol. 2, pp. 464-474, 2003. Available at: https://doi.org/10.3923/ajps.2003.467.474.