Scholars Journal of Agriculture and Veterinary Sciences (SJAVS) **e-ISSN 2348–1854**
Abbreviated Key Title: Sch. J. Agric. Vet. Sci. **p-ISSN 2348–8883**

A Unit of Scholars Academic and Scientific Society, India
www.saspublishers.com

Effect of Nitrogen Doses and Water Stress during Post Anthesis on Wheat Growth in High Terrace Soil of Sudan

Azza Eltag Elkhalil[1], Yassin M. Dagash[2], Sami Abd Elgafar Mahagoub[3], Samia O Yagoub[2*]
[1]Ministry of Agriculture- Dongla, Sudan
[2]Department of Agronomy, Faculty of Agricultural studies, Sudan University of Science and Technology, Khartoum North, Sudan
[3]Faculty of Agriculture, Dongla University, Sudan

Original Research Article

***Corresponding author**
Samia O Yagoub

Article History
Received: 01.07.2018
Accepted: 19.07.2018
Published: 30.07.2018

DOI:
10.36347/sjavs.2018.v05i07.007

Abstract: The experiment was conducted during the seasons of 2013/2014 and 2014/2015 at high terrace soil, Dongola, Northern State, Sudan. The objective of this study was to determine the effect of nitrogen levels, verities and irrigation intervals during post anthesis on growth of wheat. Experimental design used was randomized complete block in split-split plot arrangement with three replications. The main plot was consisted of three water intervals (start during post antheis formation 7,14 and 21days) and the Subplots were consisted of two varieties (Wadi El Neil and EL Neileen) while Sub-sub plot consisted of four nitrogen levels in form of urea (43, 86 and 129 kg N/ha). The vegetative and reproductive growth parameters that studied were plant height, number of tillers /meter square, leaf area index. Nitrogen significantly affected all vegetative growth parameters in both seasons with the exception on leaf area index, which exhibited significant differences in the second season only. Irrigation intervals affected all vegetative growth in both seasons. Wheat varieties significantly affected leaf area index in both seasons and effect land height in the first season.
Keyword: Nitrogen, water stress, wheat, post anthesis, Terrace soil, Sudan.

INTRODUCTION

Wheat (*triticum aestivum* L) covers most of the earth's surface compared to other food crops. It is the third largest cereal in terms of production worldwide, after maize and rice [1]. It can be cultivated in a wide range of agricultural environments. Whereas, in terms of dietary intake; wheat comes second to rice as a main food crop[2].

Wheat is the second most important cereal crop in the Sudan after sorghum. As a single crop, it occupies the largest area in the irrigated schemes. Many factors are known to affect productivity of wheat in the main growing areas in the Sudan. In Sudan, wheat is exclusively produced under irrigation during the period from November to March. This period is shorter and has relatively higher temperature than those of traditional wheat producing regions of the world. Heat tolerant wheat natures are transforming wheat production in Sudan introduced alongside an integrated package of innovation technologies and practices. The varieties are generating stable yields up of six ton per hectare. The result higher farmer production and incomes and reduced the cost of food imports [1].

Deficit irrigation has been widely investigated as a valuable and sustainable production strategy in dry regions .limiting water irrigation during drought sensitive growth stage may stabilize yields; thus, obtaining maximum water production rather maximum yield [3]. Water demand for irrigation can be reduced and water saved can be diverted for alternative uses. Decrease soil water potential increase the total resistance in the soil plant system, which lead to reduced photosynthetic activity and growth [4]. At high terrace, (North Sudan) [5]. Studied the effect of different watering regimes on growth of two cultivars; the results reviled significant difference in dry weight, plant high and number of tillers/ plant due to the effect of watering regimes and cultivars but interaction of watering regime had no clear effect for all parameters of growth.

Water and nutrient availability are major limiting factors of wheat production in the world [6]. Strategies of regulated irrigation and fertilization are one of the most practical ways in saving irrigation water and N. fertilizer of farmland in arid and semi-arid regions [7, 8] reported that poor soil management and low water and nutrient inputs lead to reduction in yield of wheat.

Efficient N fertilizer management is critical for economic production of wheat and long-term production of environmental quality [9]. Addition of nitrogen fertilizer to wheat is required to ensure that nitrogen is available throughout the growing season due to the important role in promoting both vegetative and reproductive growth.

Crop production in arid and semi-arid region is restricted by soil deficiency in moisture and plant nutrient especially nitrogen. Consequently, adequate levels of irrigation and nitrogen are needed. Thud this article was achieved to study the effect of nitrogen doses and water stress during post an thesis on wheat growth in high terrace soil of Sudan.

MATERIALS AND METHODS

Two field experiments were conducted during season 2013/2014 and 2014/2015 at Dongola research station farm in Northern state, Sudan (22 and 16^{o}N; 32 and 25^{o}E).The experimental area was tilled adequately to prepare a suitable seed bed. The implements used included a chisel plough (Cross plow) to break and loosen the soil and a leveler (scraper) to level the experimental area for the easy movement and uniform distribution of irrigation water. The field was then divided into three blocks (replication) each contained 24 equal plots of 2½m × 4m size. Plant was done on 1 December for both seasons. In rows 20cm apart at the seed rate of 90kg/h or 48.6gm/plot of 11 rows (3m long). Weed control was done by hand weeding ten days after sowing and then as needed throughout the growing season.

Experimental Design is a randomized complete block in split – split plots arrangement with three replications. The main plot contains irrigation and varieties in sub plot and nitrogen levels as sub subplot.

The experiment included the following treatments: Factor (A): Three irrigation intervals when the plant reach pod antheis stage (W1: 7 days, W2: 14 days and W3: 21 days).Factor (B): Two wheat varieties (V1: Wadi El Neil and V2: EL Neileen). Factor (C): Four nitrogen levels (N0: zero, N1: 43kgN/ha, N2: 86kg N/ha and N3: 129 N kg/ha).

The mean plant height was determined from ten randomly selected plants from the middle rows in each plot, measured in centimeters (cm) from the soil surface to the tip of the spike. Mean number of tillers per meter square was obtained from the middle rows in each plot.

From ten randomly selected plants from the middle rows in each plot, the area of individual green leaves (LA) was determined by measuring their length (L) and maximum width (W) and multiplying their products by 0.75 factor [15].

$$LA = L \times W \times 0.75$$

$$\textbf{LAI} = \frac{\textbf{LA} \times \textbf{Number of leaves per plant} \times \textbf{Number of plants/m}^2}{(\textbf{m}^2)}$$

The data collected were subjected to analysis of variance (ANOVA) appropriate for randomized complete block design [10]. Duncan's Multiple Range Test (DMRT) was applied for the separation of treatment means. All statistical analyses were performed using M-STAT-C program computer package.

RESULTS AND DISCUSSION

The statistical analysis revealed that Nitrogen had higher significant differences (P =0.01) in plant height in both seasons (Tables 1).In the first season the application of 129 Kg N/ha gave the highest plant height. Wheat varieties had higher significant differences in plant height (P = .01) in the first season but there were no significant differences in the second seasons (Table 1). In the first season, ELNeileen gave higher plant height than Wadi Elneil (Table 1). This variation may be due to genetic variation between the two-wheat cultivar. Similar result observed by [11] they showed significant differences between wheat cultivars for plant height. This result had the same manner with [5]. The interaction of irrigation interval wheat varieties had significant differences (P=0.05) in plant height in the first season (Table 1).

The analysis of variance showed that nitrogen had significantly affected leaf area index in the second season but there were no significant differences in the first season (Table 2). In the second season the application of 129 Kg N/ha gave higher leaf area index on the other hand, there were no different between 43, 86 and control (Table 2). Wheat varieties had higher significant differences (P =.01) leaf area index in the first season and significant differences (P = .05) in the second season (Table 2). In both seasons, Wadi El Neil gave higher leaf area index than El Neileen (Table 2). Irrigation intervals had significantly affected leaf area index in both season (Table 2). , irrigation interval 7 days gave higher leaf area index [5\ found similar result. There were no significant differences between treatment interactions in both seasons (Tables 2).

The analysis of variance indicated that nitrogen levels had highly significant differences (P = 0.01) in number of tillers per meter square in both seasons (Table 3). Application of 129 kg N/ha increased

number of tillers per meter square than 43, 86 and control in both seasons. There were no significant differences among wheat varieties in number of tillers per meter square in both seasons (Table 3) [12, 13] were reported significant differences between cultivars in tillers per meter square.

There were highly significant differences (P = 0.01) between irrigation intervals in number of tillers per meter square in the second season and significant differences (P = 0.05) in the first season (Table 3). Treatment interactions were not affected in number of tillers per meter square in both seasons (Table3). Addition of nitrogen fertilizer to wheat is required to ensure that nitrogen is available throughout growing season due to important role in promoting both vegetative and reproductive growth [14].

Table-1: Effects of nitrogen doses on plant high of wheat under post anthesis water stress level during season 2013/14 and 2014/15

	First season						Second season				
		No	N1	N2	N3	X	N0	N1	N27	N3	X
W1	V1	72.2fg	74.8fg	78.1ef	77.4fg	75.8bc	73.7fg	80.3df	77.6de	81.5de	78.2b
	V2	90.7bc	86.9cd	95.7ab	99.5a	93.0a	81.7cd	85.0ab	93.1a	97.4fg	89.3a
X		81.4b	80.9b	86.9a	88.4a	84.4a	77.7de	82.7bc	85.3ab	89.4a	83.8a
W2	V1	68.3ij	71.9gh	75.8gh	76.2af	73.1c	72.6fg	71.7de	77.7cd	85.3de	76.8b
	V2	72.8fg	79.3fg	80.0ef	85.0cd	79.3b	78.5d	79.3fg	80.1ef	85.0cd	83.7ab
X		70.6de	75.6cd	78.0bc	80.6b	76.2b	75.5f	76.7ef	81.4cd	87.5ab	80.3b
W3	V1	64.1m	65.1lm	66.1kl	67.8jk	65.8d	64.1m	65.0im	66.1kl	67.8jk	69.1c
	V2	70.0hi	76.2fg	75.2fg	79.6ef	75.3bc	70.0hi	76.2fg	75.7fg	79.6ef	77.3b
X		67.0e	70.6de	70.9de	73.7cd	70.6bc	67.1g	73.4f	74.1f	78.1d	73.2c
X		73.0c	75.7b	78.6a	80.9a		73.0c	75.7b	78.6a	80.9a	
G.M.V1	71.6b						74.7a				
G.M.V2	82.6a						83.5a				
CV%	5.1						5.09				

Key: N: Fertilizer levels (N0: zero, N1: 43kgN/ha, N2: 86kg N/ha and N3: 129 N kg/ha), W: irrigation intervals (W1: 7 days, W2: 14 days and W3: 21 days, V: wheat varieties (V1: Wadi El Neil and V2: EL Neileen).

Table-2: Effects of nitrogen doses on leaves area index of wheat under post anthesis water stress level during season 2013/14 and 2014/15

	First season						Second season				
		No	N1	N2	N3	X	N0	N1	N2	N3	X
W1	V1	1.6a	1.7a	1.6a	1.5ab	1.6a	1.6ab	1.7de	1.6a	1.6ab	1.8a
	V2	1.3ab	1.4ab	1.2bc	1.0cd	1.2b	1.3ab	1.4ab	1.1bc	1.0cd	1.3ab
X		1.5ab	1.6a	1.4ab	1.3ab	1.4a	1.5ab	1.6a	1.3ab	1.3ab	1.6a
W2	V1	1.4ab	1.5ab	1.3ab	1.3ab	1.4ab	1.4ab	1.5ab	1.3ab	1.3ab	1.6ab
	V2	0.87ef	1.0cd	1.2ab	1.3ab	1.0bc	0.87ef	1.0cd	1.2ab	1.3ab	1.1bc
X		1.1bc	1.3ab	1.2ab	1.3ab	1.2ab	1.1bc	1.3ab	1.2ab	1.4ab	1.3b
W3	V1	1.0cd	1.1ab	1.4ab	1.4ab	1.2ab	1.0cd	1.1ab	1.4ab	1.4ab	1.4ab
	V2	0.83fg	0.90de	0.67g	1.3ab	0.92c	0.83fg	0.90de	0.67g	1.3ab	0.98c
X1		0.91d	1.1cd	1.0cd	1.4ab	1.1b	0.92d	1.0cd	1.0cd	1.4ab	1.2b
X2		1.2a	1.3a	1.2a	1.3a		1.1b	1.4a	1.3a	1.5a	
G.M.V1	1.4a						1.6a				
G.M.V2	1.1b						1.1b				
CV%	22.12						26.29				

Key: N: Fertilizer levels (N0: zero, N1: 43kgN/ha, N2: 86kg N/ha and N3: 129 N kg/ha), W: irrigation intervals (W1: 7 days, W2: 14 days and W3: 21 days, V: wheat varieties (V1: Wadi El Neil and V2: EL Neileen).

Table-3: Effects of nitrogen doses on number of tillers/plants of wheat under post anthesis water stress level during season 2013/14 and 2014/15

	First season						Second season				
		No	N1	N2	N3	X	N0	N1	N27	N3	X
W1	V1	255.0fg	292.0bc	307.0bc	347.0a	300.3a	257.0de	294.6ab	307.3a	317.6ab	294.2a
	V2	261.3fg	3130ab	267.0ef	325.0ab	291.6ab	287.0ab	305.3ab	307.6ab	329.6a	307.4a
X		258.1de	302.5b	287.1bc	336.0a	295.9a	272.0d	300.0ab	307.5ab	323.6a	300.7a
W2	V1	253.7fg	280.0cd	289.0bc	308.6bc	282.8ab	239.6fg	302.3ab	237.6ab	313.3ab	282.2a
	V2	255.0fg	267.0ef	248.0hi	281.3cd	2628b	232.3g	275.0ab	283.0ab	321.3ab	277.9a
X		254.3de	273.5cd	268.5cd	295.0bc	272.8b	236.0e	288.6bc	278.3cd	317.3ab	280.0a
W3	V1	233.3j	269.0de	276.6cd	284.3cd	265.8b	251.6ef	287.3ab	271.3cd	293.0ab	275.8a
	V2	243.0ij	249.6gh	264.0de	302.6bc	266.08b	234.6g	289.3ab	282.6ab	301.6ab	277.0a
X1		238.1e	259.3de	272.8c	293.5bc	265.9b	243.1e	288.3bc	277.0cd	297.3ab	276.4b
X2		250.2c	278.4b	276.1b	308.1a		250.3c	292.3b	287.6b	312.7a	
G.M.V1	283.0a						284.1a				
G.M.V2	273.5a						287.5a				
CV%	7.37						8.59				

Key: N: Fertilizer levels (N0: zero, N1: 43kgN/ha, N2: 86kg N/ha and N3: 129 N kg/ha), W: irrigation intervals (W1: 7 days, W2: 14 days and W3: 21 days, V: wheat varieties (V1: Wadi El Neil and V2: EL Neileen).

REFERENCES

1. Wangi A. Effect of application elements, water stress and variety on nutrients of grain wheat in Zahak region, Iran Journal of Biodiversity and Environmental Sciences (JBES). 2009; 2220-6663.
2. Series F, Series FS, Peches N, Statistiques N, Coleccion FA. and Agriculture Organization of the United Nations. Rome. 1980;28:237-82.
3. Akram M. Growth and yield components of wheat under water stress of different growth stages. Bangladesh Journal of Agricultural Research. 2011;36(3):455-68.
4. Ali MH, Hoque MR., Hassan AA, Khair AA. Effects of deficient irrigation on yield, water productivity, and economics returned of wheat. Agricultural water management. 2007; 92(3):151-161.
5. Yagoub SO, Elkhalil AE, Balasio ED. Effect of different watering regimes on growth of two wheat (Triticum aestivum L) cultivars at high terraces of North Sudan. International Journal of AgriScience. 2012;2(8):684-95.
6. Curtis BC. Wheat in the World. In: Curtis B.C., Rajaram, S. and Macpherson, H.G. Eds., Bread Wheat Improvement and Production Plant Production and Protection Series. 2002; 30, FAO, Roma1-18
7. Abdelkhalek AA, Darwesh RK, El-Mansoury MA. Response of some wheat varieties to irrigation and nitrogen fertilization using ammonia gas in North Nile Delta region. Annals of Agricultural Sciences. 2015 Dec 1;60(2):245-56.
8. Tesfamichael F, Tripathi RP, Tesfai M. Irrigation and Nitrogen Requirements of Wheat under Shallow Water Table Conditions of Asmara, Eritrea. Journal of Geoscience and Environment Protection. 2016 Apr 11;4(04):80.
9. Mullen RW, Freeman KW, Raun WR, Johnson GV, Stone ML, Solie JB. Identifying an in-season response index and the potential to increase wheat yield with nitrogen. Agronomy Journal. 2003 Mar 1;95(2):347-51.
10. Gomez KA, Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley & Sons; 1984 Feb 17.
11. Rashid MH, Samanta SC, Biswas P, Mannan MA, Zaman AK. Performance of thirty wheat genotypes under late sown conditions in southern region of Bangladesh. Asian J. Plant Sci. 2004;3(3):286-9.
12. Carr PM, Horsley RD, Poland WW. Tillage and seeding rate effects on wheat cultivars. Crop science. 2003 Jan 1;43(1):210-8.
13. Khan N, Qasim M. Genotypic variation in wheat genotypes under agro-climatic condition ofKaghan

valley [Pakistan]. Asian Journal of Plant Sciences (Pakistan). 2004.
14. Maulood PM. Effect of Levels of Nitrogen, Irrigation, and Wheat Cultivars on Growth, Yield and Chemical Composition of Wheat (Triticum aestivum L.).
15. Bueno AL, Atkins RE. Estimation of individual leaf areas in grain sorghum. Iowa State Journal of Research. 1981.