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IMPACT OF IRRIGATION INTERVALS AND N- LEVELS ON WATER PRODUCTIVITY, GROWTH AND YIELD OF GIZA ١٧٩ RICE VARIETY UNDER DRILL- SEEDED METHOD

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ABSTRACT

Two field experiments were conducted at the Farm of Sakha Agricultural Research Station, Sakha,Kafr- ELsheikh, Egypt during ٢٠١٢ and ٢٠١٣ summer seasons. The study aimed to find out the proper nitrogen levels of drill seeded rice of Giza١٧٩ rice cultivar under prolonged irrigation interval. The experiment was performed in strip-plot design with four replications. The horizontal plots were devoted to three irrigation treatments; continuous flooding (CF) every ٣ days, irrigation every ٦ and ٩ days. The nitrogen levels Viz; ٠, ١١٠, ١٦٥ and ٢٢٠ kg Nha$^{-١}$ were distributed in the vertical plots. The main results revealed that the growth characteristics as well as grain yield and its attributes were significantly affected by the irrigation intervals in both season of study. flag leaf area, leaf area index,chlorophyll content, plant height, number of tillers/m-^{٢}, number of paniclesm-^{٢},number of filled grains panicle$^{-١}$, ١٠٠٠-grain weight, grain yield tha$^{-١}$ and straw yield tha$^{-١}$ were decreased as irrigation intervals were prolonged up ٩ days in the two seasons of study. On the other hand, the period from sowing to heading was prolonged and sterility% was increased. Harvest index wasn't affected by irrigation intervals in both seasons. Both irrigation intervals of CF and ٦ days were at a par regarding rice grain yield of both seasons of study while, panicles number/m-^{٢} and filled grainspanicle$^{-١}$ showed the same pattern in ٢٠١٢ season. Water use efficiency was found to be optimum with irrigation interval of ٦- days, with water save % amounted to be ٦,٩٣- ٥,٧٨..Meanwhile, prolonged irrigation interval up to ٩ days gave the highest of water save %(١٨,٨-١٩,٥٪) and yield reduction.Increasing nitrogen level up to ٢٢٠ kg Nha$^{-١}$ significantly increased all studied traits without significant differences with those produced by ١٦٥ kg Nha$^{-١}$ in most assessed traits and rice grain yield in both seasons of study. On controversy, sterility% significantly decreased as nitrogen level was increased up to ١٦٥kgNha$^{-١}$ while beyond the latter level the sterility% started to slightly increase. Increasing nitrogen level clearly increased water use efficiency.The interaction effect had significant effect on flag leaf area, leaf area index, plant height, number of tillersm$^{-٢}$, number of paniclesm$^{-٢}$, filled grains number/panicle, sterility%, ١٠٠٠-grain weight, grain and straw yields in both seasons of study. The interaction effect had no significant effect on heading date, chlorophyll content and harvest index in both seasons.The interaction effect came to confirm that the irrigation every ٦ days with ١٦٥ kg Nha$^{-١}$ was being to be effective in increasing water use efficiencies, water save and maintain reasonable grain yield.Under prolonged irrigation interval, increasing nitrogen level could relief the harmful of water stress.

It could be concluded that the nitrogen level of ١٦٥ kg Nha$^{-١}$ and irrigation every ٦-day is relevant for drilled Giza ١٧٩ rice variety providing high water use efficiency with high yield and reasonable water save percentage.

Keywords: drill seeded rice, irrigation intervals, and Nitrogen levels

INTRODUCTION

Irrigated rice crop is increasingly facing water scarcity. More progress has been made for water saving with more rice production.Furthermore, water efficient irrigation regimes for rice have been tested, advanced, applied and distributed in different regions in Egypt, particularly, under newly reclaimed saline soil. Because of continued population growth and economic developments, the demand for fresh water to meet industrial and domestic needs has increased in Egypt. Therefore, it is expected that, in near future, less water will be available for rice growing.Tabbal *et al.*(٢٠٠٢) reported that reduced water inputs and increased water productively of rice grown just under saturated soil conditions were compared with traditional flooding rice. Khafaga *et al.*(٢٠٠٦)and Zayed *et al.*(٢٠٠٧) stated that continuous flooding and watering at ٦ days intervals were comparable regarding, rice growth, yield attributing traits and grain yield, but the irrigation interval of ٦ days gave the highest value of water use efficiency and water productivity. Moreover, Anbumozhi *et al.*(١٩٩٨), EL-Kholy *et al.*(١٩٩٩), El Refaee *et al.*(٢٠٠٥) and Majied. (٢٠١٢) came to similar results. Khafaga *et al.*(٢٠٠٦) found that the percolation losses and evapotranspiration (ETa)were increased by increasing ponding water depth

Water and nutrients availability are two major constraints in rice fields in Egypt. Both stresses interact and contribute to low rice productivity. Many Egyptian farmers are shifting rice establishment method from transplanting in puddle soil to direct seeding in either puddle soil or dry soil after dry tillage because the latter requires less labour, time, drudgery and cultivation cost (El-Ekhtyar, ٢٠٠٤and Farooq *et al.*,٢٠٠٩ and ٢٠١١). Direct seeding requires only ٣٤٪ of the total labour requirement of transplanted rice (Ho Nai-KinandRomli ٢٠٠٢) and ٢٩٪of the total cost of transplanted rice production without any yield loss. Drill seeding, a variant of direct seeding, is sowing the seeds in rows at specified seed rate, depth, and covers those with soil under dry or moist condition. This method of rice establishment substantially reduces labour requirement, improves emergence of seeds, and reduces lodging to less than ١٠٪ (Bakker*et al.*, ٢٠٠٢).Nitrogen fertilizer management in direct-seeded rice cultivation is important and a challenging task to achieve high yield and increased N use efficiency (NUE). In general, N uptake is less than ٤٠٪ of the total N applied in rice cultivation (Ladha *et al.*, ٢٠٠٥). The low level of N utilization is due to high N losses through volatilization, de-nitrification, runoff, and leaching. Application of N not synchronized with plant need leads to high N losses, low yield, and poor grain quality. Nitrogen uptake patterns over the growing season depend on the availability of soil N, timing of fertilizer application, and amount of fertilizer N available (Ladha *et al.*, ٢٠٠٥). Increasing nitrogen rates from ١٥٠ – ١٦٥ kg Nha-١ significantly increased rice growth, yield and yield attributing characteristics of drill seeded rice (Ali *et al.*, ٢٠١٢ and El- HabitHowida *et al.*, ٢٠١٣). Zayed *et al.* (٢٠٠٦) found that NUE was higher with low nitrogen levels and was lower with increasing nitrogen level. El-Refaee *et al.*(٢٠٠٨) indicated that significant amount of irrigation water can be saved was small yield reduction if rice field was irrigated every ٦ days using ١٦٥ kg Nha$^{-١}$.

Information on nitrogen use efficiency(NUE), water use efficiency(WUE) andnitrogen (N) balance under intermittent irrigation management approach rice are imperative in making sound fertilizer recommendations that reduce N losses, save water and maintain potential yield of drill-seeded rice. Research findings on NUE and N balance in paired and single-row planting methods in drill-seeded rice are, however, meager.

This paper presents the results of a field study conducted to evaluate the various irrigation intervals (irrigation intermittent system) and five N management strategies on crop and water productivity and N use-efficiency.

MATERIALS AND METHODS

Two field experiments were conducted at Sakah Agricultural Research Station Farm during summer seasons of ٢٠١٢ and ٢٠١٣.Soil texture of the experimental sites is classified as clay soil and its chemical analysis was presented in Table١. New released variety Giza ١٧٩ was used in this study .The experiment was laid out in strip plot design with four replications. The horizontal plots were devoted to three irrigation intervals; continuous flooding with irrigating every ٣ days (CF), irrigation intervals every ٦ and ٩ days. Meanwhile nitrogen levels; ٠،١١٠،١٦٥ and ٢٢٠ kg N ha-١ in the form of urea (٤٦٪) were allocated in the vertical plots. Soil samples were taken before land preparation at the depth of ٠-٣٠ cm from the soil surface.The soil samples were completely mixed, dried and grounded, and then physically and chemicallycharacteristics were analyzed according to Black *et al.* (١٩٦٥).Results of analysis in both seasons are shown in Table ١.

Table ١: Physical and chemical analysis of the experimental sites.

Character	**٢٠١٢**	**٢٠١٣**
Physical analysis:		
Sand (%)	١٦,٥	١٥,٥
Silt (%)	٢٨,٠	٣٠,٠
Clay (%)	٥٥,٥	٥٤,٥
Soil texture	Clayey	Clayey
Chemical analysis:		
E.C. (ds/m)	١,٨٥	١,٨٠
Organic matter (%)	١,٨١	١,٨٣
pH	٨,٠٤	٨,٠٦
Available N (ppm)	٢٨	٢٩
P (ppm)	١٤	١٥
K (ppm)	٣٥٠	٣٦٠
Fe (ppm)	٤,٥٥	٥,٠٠
Zn (ppm)	٠,٩٩	١,٠٠

The phosphorus and potassium fertilizers were applied in the forms of calcium super phosphate (١٥,٥ % $P_٢O_٥$) and potassium sulphate(٤٨٪$k_٢O$) in the rates of ٣٧ kg $P_٢O_٥$ and ٥٠$k_٢O$ha$^{-١}$,repectively. Nitrogen in the form of urea (٤٦,٥ % N) was added into three equal splits, ١/٣ at ٢٥, ٥٠ and ٧٥ days after sowing at the above nominated levels. The experimental sites were well tillage. The seeds of ١٢٠ kg ha-١ were mechanically drilled at rows of ١٧ cm spaces and ١ cm below soil surface on May,٥ in the two seasons. The weeds were controlled chemically using Saturn ٥٠٪ at ٧,٥ liters ha-١ into ٣٥٠ liter waterha-١ and sprayed at four days after drilling. The drilled soil was flashy irrigated every ٦ days interval after sowing for ٢٥ days. Zinc fertilizer at the rate of ٢٤ kg $ZnSO_{٤}$ha-١ was mixed with sand and manually broadcasted at the beginning of flooding. Then, the irrigation treatments were applied as aforementioned. Each Irrigation treatment was tightly surrounded by deep ditches with ٢ m wide and ١ m depth to isolate each other. The plot size was ١٥m^{٢}(٣m width* ٥m length).

At heading stage, plant samples from area of ٠,١٢٥m^{٢} (٠,٧٤ m length *٠,١٧m width) from each plot were taken to estimate days to heading, flag leaf area(cm^{٢}), leaf area index (LAI)) and chlorophyll content (SPAD value)according to Yoshida *et al.*(١٩٧٢). Leaf area index is the ratio between the leaf area (cm^{٢}) of the plant divided by ground area occupied by the plants (cm^{٢}) and chlorophyll content was estimated by chlorophyll meter (Model Li ٣٠٠٠L)

At harvest, plant of the area of ٠,١٢٥m^{٢}(٧٤cm length x١٧cm width) from each plot were counted to determine number of tillers m-^{٢} and number of panicles m$^{-٢}$ and the plant height (cm) was measured. Ten main panicles from each plot were packed to determine number of filled grains panicle $^{-١}$, sterility% and ١٠٠٠-grain weight (g).

The plants in the central rows of ١٠ m^{٢} of each plot were harvested, dried, threshed, then grain and straw yields were determined at ١٤ % moisture content and converted into t ha$^{-١}$ as well as harvest index.

The volume of irrigation water applied in each plot was measured by a calibrated water meter with water pump . The amount water before treatments application (the first ٢٥ days period of drilled rice growth was recorded as well as water required for irrigation treatments of all experiments. Water use efficiency was calculated according to Michael (١٩٧٨).

All data collected were subjected to standard statistical analysis following the proceeding described by Gomez and Gomez (١٩٨٤) using the computer program (MSTAT). The treatment means were compared using Duncan's multiple range test Duncan (١٩٥٥). * and ** symbol used in all Tables indicate the significant at ٥٪ and ١٪ levels of probability, respectively, while, NS means not significant.

RESULTS AND DISCUSSIONS

Effect of irrigation intervals

Data furnished in Table ٢ revealed that the irrigation intervals significantly influenced the studied growth parameters under such conditions in both seasons. Prolonging irrigation intervals up to nine days severely declined growth of Giza ١٧٩ rice variety in ٢٠١٢ and ٢٠١٣ seasons, respectively. The intermittent irrigation interval of ٦ days slightly affected rice growth. It is clear that the continuous flooding gave the highest means of tested rice growth characteristics, flag leaf area, leaf are index and chlorophyll content in both seasons (Table ٢). On the other hand, the prolonged irrigation interval of ٩ days produced the minimum values of growth parameters in the first and second seasons, respectively. The irrigation every ٩ days gave the longest period from sowing to heading.Water stress increased osmotic pressure resulted in high water potential inside plant cells, low water content, low photosynthesis rate and low metabolism process. Furthermore, the water stress might affect cell division and elongation resulted short plants, narrow leaves leading to small leaf area index and flag leaf area. Low water content of leaf induced by water stress might destroy chlorophyll pigments resulted in low chlorophyll content led to low photosynthesis and dry matter production. Water stress might increase antioxidants releasing in plant cell which damaged the cell membranes and the protein shrinking as a result of water imbalance. Under water stress, the respiration rate might be increased resulted in more water and energy losses against anabolism and ultimately induced starvation and very low growth rate. Water stress might also affect rice roots growth and its capability of nutrient and water absorption. The water stress affected plant phenology because the recovery period after each cycle of stress and watering resulted in delaying or accelerating heading date based the intensity of water stress and rice variety in self. Similar data had been reported by El-Ekhtyar (٢٠٠٤), Zayed *et al.* (٢٠٠٧), and Majid (٢٠١٢).

Results of variation analysis show that measured properties ofplant height, tillers number, panicles number, number of filled grains panicle-١, sterility%, and weight of ١٠٠٠ grain have a significant difference in irrigation intervals. Prolonging irrigation intervals up to ٩ days significantly diminished the yield attributes giving the lowest values of these properties. The continuous flooding (CF) gave the highest values of number of tillers, number of panicles, filled grainspanicle-١ and ١٠٠٠-grain weight without significant differences with those produced by ٦-irrigation interval in the first season regarding the first two traits (Table٥&٩). Meanwhile, the CF treatment gave the lowest values of sterility% in both seasons (Table٥&٩). In the second season, both irrigation intervals of CF and ٦-day were at the same level of significant regarding sterility %. Since water stress significantly might be restricted rice growth and other metabolism processes of rice plants as well as increasing catabolism against anabolism that resulted poor yield attributes. Similar results under drill seeded rice had been reported by El-Ekhtyar (٢٠٠٤) and Ali *et al.*(٢٠١٢).

Data inserted in Table ١٣ showed that the irrigation intervals had significant effect of grain and straw yields in both seasons. On the other way, the irrigation intervals didn't show any significant effect of harvest index in the ٢٠١٢ and ٢٠١٣ seasons. The CF treatment gave the highest values of grain and straw yields in both seasons. Interestingly, the irrigation treatments of CF and ٦-days interval were statically placed at the same group regarding the grain and straw yields in both seasons. Thereby, the irrigation interval of ٦ days could be recommended under current water shortage and tolerant varieties such as Giza ١٧٩ as well as drill seeded rice. The minimum values of rice grain yield were produced when rice plants were irrigated every ٩ days in both seasons of study (Table١٣). Water stress significantly restricted yield components particularly, plant population/unit area, bearing tillers number m-٢, and panicle characteristics involving, filled grains, weights of panicle and individual grain. Furthermore, the water stress might be affected panicle peduncle elongation, assimilates translocation due to more exertion of ABA which blocks this translocation, affecting current photosynthesis resulted in low grain filling rate. In addition, water stress might affect the root system growth and its ability of nutrient and water uptake resulted in shoot growth inhibition and ultimately declined rice grain yield. Similar results were claimed by El-Ekhtyar(٢٠٠٤),Majid (٢٠١٢)and Ali *et al.*(٢٠١٢).

Table ٢:Effect of irrigation intervals and nitrogen levels on heading date, flag leaf area, leaf area index and chlorophyll content of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons.

Treatments	Heading date(days)		Flag leaf area($cm^{٢}$)		Leaf area index(LAI)		Leaf chlorophyll content (SPAD value	
	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٤
A:Irrigation intervals								
Continuous flooding(CF)	٩١,٩b	٩٠,٦c	٢٤,٠٢a	٢٤,٢٨a	٦,١٩a	٦,٣٦a	٣٣,٢٤a	٣٢,٥٦a
Irrigation every ٦ days	٩٤,٤a	٩٢,٨b	٢٢,٩٤b	٢٣,٣٤b	٦,١٣a	٦,٢٤b	٣٢,٠٧b	٣١,٠٤b
Irrigation every ٩ days	٩٥,٣a	٩٤,٧a	١٧,٣٢c	١٧,٤٣c	٥,٠٤b	٥,١٢b	٢٧,٩٦c	٢٧,٢٣c
F. Test	*	**	**	**	**	**	**	**
B: Nitrogen levels (kg Nha$^{-١}$)								
٠	٩٠,٨d	٨٨,٧c	١٧,٥٢c	١٦,٩٩c	٤,٨٣c	٤,٨٥d	٢٨,٢١c	٢٧,٨٢c
١١٠	٩٢,٩c	٩٢,١b	٢٠,٨١b	٢١,٢٧b	٥,٥٨b	٥,٧٦c	٣١,٠٣b	٢٩,٩٨b
١٦٥	٩٥,٢b	٩٤,٦a	٢٣,٢٣a	٢٣,٨٤a	٦,٢١a	٦,٢٧b	٣٢,١٩a	٣١,٢٧a
٢٢٠	٩٦,٥a	٩٥,٤a	٢٤,١٧a	٢٤,٦٣a	٦,٦٤a	٦,٧٣a	٣٢,٨٨a	٣٢,٠٥a
F. Test	*	*	**	**	**	**	**	**
A x B Interaction:	N.S	N.S	**	**	**	**	NS	NS

Means: followed by the same litter (s) are not significantly different, according to DMRT.*, and N.S.: Significant at ٠,٠٥ and ٠,٠١ levels and not significant, respectively.**

Table ٣: Effect of the interaction between irrigation intervals and nitrogen levels on flag leaf area ($cm^{٢}$)of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons.

Nitrogen levels (kg Nha$^{-١}$)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	١٩,١٢ef	١٩,٨٠e	١٣,٦٣g	١٨,٤٩gh	١٩,٥٣fg	١٢,٩٤i
١١٠	٢٢,٩٥cd	٢٢,١٩d	١٧,٢٨f	٢٣,٦٧de	٢٢,٧٩e	١٧,٣٦h
١٦٥	٢٦,٦٨a	٢٤,٠٥bc	١٨,٩٦ef	٢٧,١٥ab	٢٤,٨٩cd	١٩,٤٨fg
٢٢٠	٢٧,٣٥a	٢٥,٧٣ab	١٩,٤٢e	٢٧,٨١a	٢٦,١٦bc	١٩,٣٢f

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Table ٤:Effect of the interaction between irrigation intervals and nitrogen levels on leaf area index(LAI) of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons

Nitrogen levels (kg $Nha^{-١}$)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٥,٢٣fg	٥,١٠g	٤,١٦i	٥,٢٦e	٥,٠٢ef	٤,٢٧g
١١٠	٦,٠٩cd	٥,٩٧d	٤,٦٩h	٦,٣٧bc	٦,١٨c	٤,٧٣f
١٦٥	٦,٤٦ab	٦,٤٢bc	٥,٥٧ef	٦,٥٩b	٦,٥٥bc	٥,٦٨d
٢٢٠	٧,١٧a	٧,٠٣a	٥,٧٤de	٧,٢١a	٧,١٩a	٥,٧٩d

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Effect of nitrogen levels:

Nitrogen treatments significantly influenced the growth; heading date, flag leaf area, leaf area index (LAI) and chlorophyll content of rice in the two study seasons (Table ٢). The measured growth parameters significantly responded to nitrogen up to ٢٢٠ kg and there were progressive improvements on growth of rice. Both nitrogen levels of ١٦٥ and ٢٢٠ were put at one group of significant. The lowest values growth properties were recorded with zero nitrogen application, while the highest values were with higher nitrogen level of ٢٢٠ kg $Nha^{-١}$. This could be owing to low available N status of the soil and ion imbalance under drill seeded rice because high plant density. It was observed that increasing nitrogen level up to ٢٢٠ kg $ha^{-١}$ significantly retarded heading.As seen in Table ٢, none of nitrogen application shortened the period from sowing to heading giving early heading date, under current drill seeded rice. Zayed *et al.*(٢٠٠٥) claimed that both low nitrogen availability accelerates the heading and shortened the vegetative period resulted in less dry mater production at pre-heading that might be produced low grain yield .Similar results were indicated by El-Habet, Howida *et al.*(٢٠١٣).

Plant height and number of tiller $m^{-٢}$ were significantly increased as nitrogen levels increased up to ٢٢٠ kg N $ha^{-١}$(Table ٥). The higher nitrogen level of ٢٢٠ kg N $ha^{-١}$recorded the highest values of plant height and tillers number $m^{-٢}$, while the lowest values of them were produced by non-nitrogen fertilizer. Nitrogen fertilizer treatments had significant and positive impact on yield attributes in both seasons (Tables٥&٩). Increasing nitrogen level up to ٢٢٠ kg $Nha^{-١}$ significantly increased panicle numbers $m^{-٢}$ and filled grains $panicle^{-١}$, but the increment in ١٠٠٠- grain weight was up to ١٦٥ kg $ha^{-١}$. However, increasing nitrogen rates up to ٢٢٠ kg $ha^{-١}$ reduced ١٠٠٠-grain weight without significant mean with that of ١٦٥ $kgNha^{-١}$. The rate of ٢٢٠ kg $ha^{-١}$ failed to lower the number of unfilled grains % comparing only with its proceeding rate of ١٦٥ kg $Nha^{-١}$. The latter nitrogen level of ١٦٥$kgNha^{-١}$ gave the lowest values of sterility% in both seasons (Table ٩).

The zero nitrogen application exerted the highest values of sterility%. In the two season of study, the nitrogen of ٢٢٠ and ١٦٥ kg $Nha^{-١}$ levels were at apar regarding panicles number and filled grains /panicle. At the same time, the treatment of zero nitrogen application recoded the lowest values of yield attributes. The improvement of the yield attributes as a result of increasing nitrogen levels might due to increase translocation of photosynthesis from source to sink during grain filling as well as improving rice growth traits and grain filling. That might be due to stimulate the vigorous growth superficial roots ,increased the synthesis of cytokinins (mainly Zeatian) in roots, and delayed the appearance of the absesic acid (ABA) peak in both leaves and filling grains.High ratio of Zeatian /ABA enhanced the synthesis of RNA, which resulted in protein synthesis for carbon assimilation and transportation (Yang and Sun., ١٩٩٢). Zayed *et al.*(٢٠٠٧) and El-Habat,Howida*et al.*(٢٠١٣) reached similar results.

The nitrogen levels significantly improved and affected rice grain and straw yields as well as harvest index in the first and second seasons, respectively (Table١٣). The grain and straw yields gradually increased as nitrogen levels were increases up to ٢٢٠ kgNha$^{-١}$. For rice grain yield, the nitrogen level of ٢٢٠kgNha$^{-١}$ gave the highest values of grain yield without significant differences with those released by nitrogen level of ١٦٥ kgNha$^{-١}$ in both seasons of study(Table١٣). The maximum values of straw yield were exerted by higher nitrogen level in the two seasons of study. Harvest index recorded its highest value with nitrogen level of ١٦٥kgNha$^{-١}$ without any significant differences with those produced by nitrogen level of ١١٠ kg Nha$^{-١}$ in the first and second season(Table١٣). It seems that the higher nitrogen level ٠f ٢٢٠ kg Nha$^{-١}$ was being ineffective in improving harvest index since it failed to produce more grain against straw. Moreover, increasing nitrogen beyond ١٦٥kgNha$^{-١}$ significantly reduced the harvest index in the two seasons of study (Table ١٣). The lowest values of yields and harvest index were recorded when rice plants didn't receive any applied nitrogen. A significant higher grain yield at the highest level of nitrogen was obtained ,might be owing to better N uptake leading to greater dry matter production and its translocation to the sink .Increased panicle numbers hill$^{-١}$, filled grains panicle $^{-١}$ and grain weight were mainly responsible for the increased yield at this level of nitrogen. Majid (٢٠١٢) and El-Habet,Howida *et al.*(٢٠١٣) came to similar results.

Table ٥: Effect of irrigation intervals and nitrogen levels on plant height, number of tillersm$^{-٢}$ and number of panicles m-^{٢} of Giza ١٧٩ rice cultivar during ٢٠١٣ and ٢٠١٣ seasons.

Treatments	Plant height(cm)		Number of tillersm-^{٢}		Number of panicles m-^{٢}	
	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
A:Irrigation intervals :						
Continuous flooding(CF)	٩٢,٨a	٩١,٧a	٤٩٣a	٤٨٢a	٤٩٠a	٤٨٧a
Irrigation every ٦ days	٩١,٢b	٩٠,٥b	٤٧٨b	٤٦٩b	٤٧٦a	٤٦٦b
Irrigation every ٩ days	٨٨,٧c	٨٧,٨c	٤٢٧c	٤١٨c	٤٢٥b	٤١٦c
F. Test	**	**	**	**	**	**
B:Nitrogen levels (kg Nha$^{-١}$):						
٠	٨٥,٧d	٨٤,٩c	٣٩٢d	٣٧٩c	٣٩١d	٣٧٥c
١١٠	٩٠,٣c	٨٨,٧b	٤٦٥c	٤٥٧b	٤٦٢c	٤٥٤b
١٦٥	٩٢,٥b	٩٢,٦a	٤٩٦b	٤٩١a	٤٩٣b	٤٨٨a
٢٢٠	٩٤,٩a	٩٣,٨a	٥١٢a	٤٩٨a	٥٠٩a	٤٩٧a
F. Test	**	**	**	**	**	**
Ax B Interaction:	**	**	*	*	*	*

Means: followed by the same litter (s) are not significantly different, according to DMRT.*, and N.S.: Significant at ٠,٠٥ and ٠,٠١ levels and not significant, respectively.**

Table ٦:Effect of the interaction between irrigation intervals and nitrogen levels on plant height (cm) of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons

Nitrogen levels (kg Nha-١)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٨٨,٤g	٨٥,٤i	٨٣,٣j	٨٧,٩e	٨٤,٧g	٨٢,١h
١١٠	٩٢,٥de	٩١,٣ef	٨٧,١h	٩٠,٢d	٨٩,٦d	٨٦,٣f
١٦٥	٩٤,٣bc	٩٢,٨d	٩٠,٥f	٩٣,٤b	٨٣,٨b	٩٠,٧d
٢٢٠	٩٥,٨a	٩٥,٢ab	٩٣,٧cd	٩٥,٣a	٩٣,٩b	٩٢,٢c

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Table ٧:Effect of the interaction between irrigation intervals and nitrogen levels on number of tillers/m-٢ of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons

Nitrogen levels (kg Nha-١)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٤١٦f	٣٩٧g	٣٦٣h	٤٠٥e	٣٩٨e	٣٣٤f
١١٠	٤٩٢c	٤٨٢cd	٤٢١f	٤٨٦b	٤٥٦c	٤٢٩d
١٦٥	٥٢٣b	٥١٥b	٤٤٨e	٥١٢a	٥٠٩a	٤٥٢c
٢٢٠	٥٤١a	٥١٩b	٤٧٦d	٥٢٣a	٥١٤a	٤٥٨c

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Table٨:Effect of the interaction between irrigation intervals and nitrogen levels on number of panicles m-٢ of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons.

Nitrogen levels (kg Nha-١)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٤١٢f	٣٩٤f	٣٦٧g	٤٠٢e	٣٩٣e	٣٢٩f
١١٠	٤٩١cd	٤٧٩d	٤١٧f	٤٨١b	٤٥٤c	٤٢٨d
١٦٥	٥٢٠ab	٥١٣bc	٤٤٦e	٥٠١a	٥٠٧a	٤٤٩c
٢٢٠	٥٣٩a	٥١٧ab	٤٧١d	٥٦٤a	٥١١a	٤٥٦c

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Table ٩: Some yield components of Giza ١٧٩ rice cultivar as influenced by irrigation intervals and nitrogen levels during ٢٠١٢ and ٢٠١٣ seasons

Treatments	Number of filled grains/panicle		Sterility percentage		١٠٠٠-grain weight (g)	
	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
A. Irrigation intervals						
Continuous flooding(CF)	١١١,٦a	١٠٨,٨a	٥,٠١b	٤,٧٩b	٢٧,١٣a	٢٧,٢٩a
Irrigation every ٦ days	١١٠,٠a	١٠٤,٤b	٤,٨٣c	٤,٨٤b	٢٦,٤٩b	٢٦,٥٧b
Irrigation every ٩ days	٩٠,٤b	٨٦,٨c	٦,٤٩a	٦,٤١a	٢٤,٦٤c	٢٤,٨٤c
F. Test	**	**	**	*	**	**
B.Nitrogen levels (kg Nha-١)						
٠	٨٤,٥d	٧٩,٢d	٦,٠٢a	٥,٨٧a	٢٥,٣٩c	٢٥,٦٥c
١١٠	٩٧,٦c	٩٣,٥c	٥,٥٤b	٥,٤٧b	٢٥,٨٥b	٢٦,٠٢b
١٦٥	١١٣,٩b	١٠٨,٨b	٤,٩٩d	٤,٩٦c	٢٦,٥٧a	٢٦,٦٨a
٢٢٠	١٢٠,٠a	١١٨,٣a	٥,٢٢c	٥,٠٨c	٢٦,٥٣a	٢٦,٥٩a
F. Test	**	**	**	**	**	**
A x B Interaction:	**	**	**	**	**	**

Means: followed by the same litter (s) are not significantly different, according to DMRT.
***,** and N.S.: Significant at ٠,٠٥ and ٠,٠١ levels and not significant, respectively.**

Table ١٠:Effect of the interaction between irrigation intervals and nitrogen levels on number of filled grains/panicle of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons.

Nitrogen levels (kg Nha$^{-١}$)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٩١,٣g	٨٨,٢h	٧٤,١j	٩٢,٤g	٧٩,٩i	٦٥,٤j
١١٠	١٠٣,٧e	١٠٥,٥d	٨٣,٥i	١٠٥,٤d	٩٢,٦g	٨٢,٥h
١٦٥	١٢٢,٤c	١٢١,٠c	٩٨,٢f	١١١,٦c	١١٨,١b	٩٦,٧f
٢٢٠	١٢٨,٩a	١٢٥,٤b	١٠٥,٦d	١٢٥,٦a	١٢٦,٨a	١٠٢,٤e

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Table ١١: Effect of the interaction between irrigation intervals and nitrogen levels on sterility percentage of Giza ١٧٩ rice cultivar during ٢٠١٢and ٢٠١٣ seasons.

Nitrogen levels (kg Nha$^{-١}$)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٥,٣٧e	٥,٦٨d	٧,٠١a	٥,٢٦cd	٥,٥٢c	٦,٨٤a
١١٠	٥,١٠ef	٥,٢٥e	٦,٢٦bc	٤,٩٩d	٥,٢٠d	٦,٢٢b
١٦٥	٤,٧٢g	٤,١١h	٦,١٤c	٤,٥٣e	٤,٣٣e	٦,٠٢b
٢٢٠	٤,٨٥fg	٤,٢٩h	٦,٥٣b	٤,٣٦e	٤,٣١e	٦,٥٧a

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Table ١٢: Effect of the interaction between irrigation intervals and nitrogen levels on ١٠٠٠-grain weight (g) of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons

Nitrogen levels (kg Nha$^{-١}$)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٢٦,١٦de	٢٥,٥٤ef	٢٤,٤٧g	٢٦,٢٩cd	٢٥,٧٤de	٢٤,٩٢ef
١١٠	٢٦,٨٩bcd	٢٦,٣٨cd	٢٤,٢٩g	٢٧,١١bc	٢٦,٤٩cd	٢٤,٤٦f
١٦٥	٢٨,٠٢a	٢٦,٩٢bc	٢٤,٧٦g	٢٨,٢٣a	٢٧,٠١bc	٢٤,٨٠f
٢٢٠	٢٧,٤٣ab	٢٧,١٣bc	٢٥,٠٤fg	٢٧,٥٤ab	٢٧,٠٥bc	٢٥,١٨ef

Means: followed by the same litter (s) are not significantly different, according to DMRT.

The interaction effect:

Variation analysis of data indicated that the interaction between irrigation intervals and nitrogen levels had significant effect on flag leaf area and leaf area index in both seasons. The combinations of CF with N level of ٢٢٠ kg Nha$^{-١}$ gave the highest values of both mentioned traits. Contrary, the lowest values of them were with the combination of zero nitrogen application and irrigation intervals of ٩ days in both seasons (Tables ٣ and ٤). The three combinations of CF with١٦٥ kg Nha$^{-١}$, CF with٢٢٠ kgNha$^{-١}$ and ٦ days with

٢٢٠ kg were at the same level of significant in the first season, while, in the second season, the couple combinations of CF with٢٢٠ kg Nha$^{-١}$ and ٦ days with ٢٢٠ kg showed similar pattern in both traits (Table٣). Moreover, under long irrigation interval of ٩ days the higher nitrogen level of ٢٢٠kg Nha$^{-١}$ was being effective in relieving the effect of water stress on plant growth.Furthermore, nitrogen application at the higher rate could ameliorate the undesirable effect of water stress of prolonged irrigation interval of ٩ days by developing extensive root growth, large leaf area, more dry matter production and considerable net photosynthesis. The well root growth induced by higher nitrogen level under prolonged irrigation interval of ٩ days enable stressed rice plants to take an adequate water and nutrient keeping health growth. At the same time supplying plant by an adequate nitrogen could delay early aging in the terms of senescence happened by water stress ensuring optimum growth and yield even with water stress.

Data listed in Tables ٦&٧ indicated that the interaction between irrigation intervals and nitrogen levels had significant effect on plant height and tillers number in both seasons. The combination of nitrogen level of ٢٢٠ kg Nha$^{-١}$ and continuous flooding produced the highest values of plant height and tillers numberhill$^{-١}$ in both seasons without any significant differences with those produced by the same nitrogen level with irrigation interval of ٦ day in in ٢٠١٢ and ٢٠١٣, respectively. The lowest means of plant height and tillers number were recorded when rice plant irrigated every ٩ days under zero nitrogen level in both seasons of study. That means increasing nitrogen could alleviate the stress effect of water on growth (Majid, ٢٠١٢)

The interaction between irrigation intervals and nitrogen level had significant effect on number of paniclem$^{-٢}$, number of filled grains panicle$^{-١}$, sterility%, and ١٠٠٠-grain weight in both seasons of study. The combination of CF and nitrogen level of ٢٢٠ kg Nha$^{-١}$ produced the highest value of panicles number without significant differences with those produced by the same nitrogen level under ٦-day interval (Tables٨). The worst combination was zero nitrogen level with ٩-days interval. As for, filled grains panicle$^{-١}$, the lowest values of filled grainspanicle$^{-١}$ were obtained by the combination of zero nitrogen level and ٩-days interval in both seasons (Table١٠). The combination of higher nitrogen level of ٢٢٠ kg Nha$^{-١}$ with CF and ٦-days interval gave the highest values of filled grainspanicle$^{-١}$ in the first and second seasons, respectively. The lowest mean of sterility% was recorded with the combination of higher nitrogen level of ٢٢٠ kgNha$^{-١}$ with CF, while the maximum values of sterility% was recorded when rice plants didn't receive any nitrogen under the irrigation interval of ٩ days(Table١١). Regarding ١٠٠٠-grain weight, the highest means of ١٠٠٠-grain weight was recorded when rice plants were fertilized by the nitrogen level of ١٦٥ kg Nha$^{-١}$ under continuous flooding in both seasons (Table١٢).The last combination statically came at the same group with the combination of ٢٢٠ kg Nha$^{-١}$ under continuous flooding. The lowest means of ١٠٠٠-grain weight were produced by the combination of zero nitrogen level and interval of ٩ days in both seasons of study (Table١٢). Majid (٢٠١٢) reported similar findings.

The interaction between irrigation intervals and nitrogen level had significant effect on grain and straw yields in ٢٠١٢ and ٢٠١٣ seasons, respectively (Table١٤). The combination of CF irrigation treatment and nitrogen level of ١٦٥ kg Nha$^{-١}$ gave the highest values of grain yield in both seasons (Tables ١٤), while, the combination of ٢٢٠ kg Nha$^{-١}$ and ٦ days interval gave the highest value of straw yield in the two seasons of study (Table١٥). Data analysis variation indicated that the combinations of CF with ١٦٥ and ٢٢٠kgNha$^{-١}$, and ٦-days interval with the same two levels were placed at the same category of significant. The rice straw yield recorded its highest value at the combination of ٢٢٠kgNha$^{-١}$ and ٦-days interval in both seasons (Table١٤&١٥). Grain and straw yields recorded their lowest means at the combination of zero nitrogen application and ٩-days interval in the two seasons of study. From current deliberations, the increasing nitrogen level up to ٢٢٠ kg could combat the harmful of water stress induced by prolonged irrigation interval of ٩ days. Similar data had been claimed by Majid (٢٠١٢).

Table ١٣: Effect of irrigation intervals and nitrogen levels on grain yield, straw yield and harvest index of Giza ١٧٩ during ٢٠١٢ and ٢٠١٣ seasons.

Treatments	Grain yield (tha$^{-١}$)		Straw yield (tha$^{-١}$)		Harvest index (HI)	
	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
A. Irrigation intervals						
Continuous flooding	٨,٧٩a	٨,٨٦a	١١,٩٩a	١٢,١٣a	٤٢,٢٦	٤٢,١٢
Irrigation every ٦ days	٨,٥٦a	٨,٦٧a	١٢,٠٨a	١٢,٢٧a	٤١,١٩	٤١,٢٢
Irrigation every ٩ days	٦,٢٩b	٦,٣٥b	٩,٢٧b	٩,٤٨b	٤٠,١٣	٣٩,٨٣
F. Test	**	**	**	**	NS	NS
B.Nitrogen levels (kg Nha$^{-١}$.):						
Control	٥,١٨c	٥,٢٣c	٧,٧٢d	٧,٨٣d	٣٩,٩٢c	٤٠,٠١c
١١٠	٧,٩٥b	٨,٠١b	١١,٠٦c	١١,٢٩c	٤١,٧١a	٤١,٣٩a
١٦٥	٩,٠٢a	٩,١٤a	١٢,٢٧b	١٢,٤١b	٤٢,١٩a	٤١,٩٦a
٢٢٠	٩,٣٦a	٩,٤٥a	١٣,٣٨a	١٣,٦٤a	٤٠,٩٧b	٤٠,٨٦b
F. Test	**	**	**	**	**	**
Ax B Interaction:	**	**	*	*	NS	NS

Means: followed by the same litter (s) are not significantly different, according to DMRT.
***,** and N.S.: Significant at ٠,٠٥ and ٠,٠١ levels and not significant, respectively.**

Table ١٤:Effect of the interaction between irrigation intervals and nitrogen levels on grain yield (tha$^{-١}$)of Giza ١٧٩ rice cultivar during ٢٠١٢ and ٢٠١٣ seasons.

Nitrogen levels (kg Nha$^{-١}$)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٥,٤٤ef	٥,٢٤f	٤,٨٨f	٥,٦٠ef	٥,٣١fg	٤,٧٩g
١١٠	٩,١٥b	٨,٧١b	٥,٩٧e	٩,١٢b	٨,٧٧b	٦,١٣de
١٦٥	١٠,٤٣a	٩,٩٦a	٦,٦٨d	١٠,٥٥a	١٠,١٣a	٦,٧٤d
٢٢٠	١٠,١٤a	١٠,٣٢a	٧,٦٣c	١٠,١٨a	١٠,٤٥a	٧,٧٢c

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Table ١٥: Effect of the interaction between irrigation intervals and nitrogen levels on straw yield (tha$^{-١}$) of Giza ١٧٩ rice cultivar during ٢٠١٣ and ٢٠١٣ seasons.

Nitrogen levels (kg Nha$^{-١}$)	Irrigation intervals					
	٢٠١٢			٢٠١٣		
	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days	Continuous flooding	Irrigation every ٦ days	Irrigation every ٩ days
٠	٧,٨٦h	٧,٩٢h	٧,٣٩h	٧,٩٧f	٨,٠٣f	٧,٤٩f
١١٠	١٢,٣٧d	١٢,١٦d	٨,٦٤g	١٢,٤٣c	١٢,٣١c	٩,١٣e
١٦٥	١٣,٧٤bc	١٣,٣٢c	٩,٧٦f	١٣,٨٦b	١٣,٥٩b	٩,٧٨e
٢٢٠	١٣,٩٨b	١٤,٨٧a	١١,٢٨e	١٤,٢٤b	١٥,١٦a	١١,٥٢d

Means: followed by the same litter (s) are not significantly different, according to DMRT.

Water relations

Data listed in Table ١٧ refer that irrigation intervals had marked variation in total applied water, water save% and water use efficiency in both seasons. The continuous flooding (CF) had the highest values of total applied water, while the prolonged irrigation interval of ٩ days recorded the minimum values of total applied water. The irrigation interval of ٩ days gave the maximum amount of water save and the CF treatment gave the least amount of water save. The intermittent irrigation interval of ٦ days clearly mediated the two irrigation treatment intervals in amount of water save. Interestingly, the highest mean of water use efficiency was obviously recorded by the irrigation interval every ٦ days with slightly yield reduction. The prolonging irrigation interval every ٩ days gave the highest value of yield reduction and water save%, but it gave the lowest values of water use efficiency. Therefore, irrigation interval every ٦ days could be recommended under drill seeded rice based on water use efficiency and other water relations (Tables ١٦ and ١٧).Similar data had been reported by Zayed *et al*. (٢٠٠٧)and Majid (٢٠١٢).

Data in Table ١٨ showed that the tested nitrogen levels markedly varied in their effect of water use efficiency in both seasons. The lowest values of water use efficiency were produced by zero nitrogen level, while the highest values of water use efficiency were produced by the highest nitrogen level of ٢٢٠ kg Nha$^{-١}$. It was observed that the combination of nitrogen level of ٢٢٠kgNha$^{-١}$ and irrigation interval of ٦ day gave the highest values of water use efficiency in both seasons (Table ١٨). Furthermore, under both irrigation intervals of ٦ and ٩ days, increasing nitrogen level linearly increased water use efficiency up to ٢٢٠ kg Nha$^{-١}$. At the same time, under continuous flooding the increasing water use efficiency was recorded up to only ١٦٥ kg Nha$^{-١}$ and the water use efficiency was decreased with high nitrogen level of ٢٢٠kgNha$^{-١}$. Similar data was claimed by Majid(٢٠١٢).

From going discussion, it could be concluded that application of nitrogen at the rate of ١٦٥ and/or ٢٢٠ kg Nha$^{-١}$ was found to be optimum for rice growth; yield and water use efficiency as well as water save allied with ٦ days irrigation intervals for drilled Giza ١٧٩ rice variety. The increasing nitrogen level up to ٢٢٠ kg Nha$^{-١}$ showed ability to relief the undesirable effect of water shortage under prolonged irrigation interval keeping high yield and reasonable WUS as well as water save even with water stress plus the others drill-seeded rice's advantages.

Table ١٦: Water use for ٢٥ days before starting irrigation treatments m^{٣}ha-^{١}., water use through irrigation treatments m^{٣}ha-^{١} and total water usedm^{٣}ha-^{١} during ٢٠١٢and ٢٠١٣ seasons.

Irrigation treatments	Water used before treatments		Water used trough treatments (m^{٣}ha$^{-١}$)		Total water used (m^{٣}ha$^{-١}$)	
	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
Continuous flooding (CF)	٢٨٨٦,٥	٢٧٩٥,٨	٩٥١٨,٧	٩٤٢٤,٦	١٢٤٠٥,٢	١٢٢٢٠,٤
Irrigation every ٦ days			٨٦٥٨,٤	٨٧١٨,٣	١١٥٤٤,٩	١١٥١٤,١
Irrigation every ٩ days			٧١٨٦,٥	٧٠٤١,٨	١٠٠٧٣,٠	٩٨٣٧,٦

Table١٧:Some water relations of Giza ١٧٩ cultivar as affected by irrigation intervals under drill-seeded rice during ٢٠١٢ and ٢٠١٣ seasons.

Irrigation treatments	Total water (m^{٣}ha$^{-١}$)		Grain yield (tha$^{-١}$)		Yield reduction (%)		Water saved (%)		Water use efficiency (WUE kgm$^{-٣}$)	
	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣	٢٠١٢	٢٠١٣
Continuous flooding (CF)	١٢٤٠٥,٢	١٢٢٢٠,٤	٨,٧٩a	٨,٨٦a	-	-	-	-	٠,٧٠٩	٠,٧٠٢٥
Irrigation every ٦ days	١١٥٤٤,٩	١١٥١٤,١	٨,٥٦a	٨,٦٧a	٢,٦٢	٢,١٤	٦,٩٣	٥,٧٨	٠,٧٤١	٠,٧٥٣
Irrigation every ٩ days	١٠٠٧٣,٠	٩٨٣٧,٦	٦,٢٩b	٦,٣٥b	٢٨,٤٤	٢٨,٣٣	١٨,٨٠	١٩,٥٠	٠,٦٢٤	٠,٦٤٥

Table ١٨:Effect of the interactionbetween irrigation intervals and nitrogen levels on water use efficiency during ٢٠١٢ and ٢٠١٣

Nitrogen levels (kg Nha$^{-١}$)	٢٠١٢			٢٠١٣		
	Continuous flooding	**Irrigation every ٦ days**	**Irrigation every ٩ days**	**Continuous flooding**	**Irrigation every ٦ days**	**Irrigation every ٩ days**
Control	٠,٤٣٩	٠,٤٥٤	٠,٤٨٤	٠,٤٥٨	٠,٤٦١	٠,٤٨٧
١١٠	٠,٧٣٨	٠,٧٥٤	٠,٥٩٣	٠,٧٤٦	٠,٧٦٢	٠,٦٢٣
١٦٥	٠,٨٤١	٠,٨٦٣	٠,٦٦٣	٠,٨٦٣	٠,٨٨٠	٠,٦٨٥
٢٢٠	٠,٨١٧	٠,٨٩٤	٠,٧٥٧	٠,٨٣٣	٠,٩٠٨	٠,٧٨٥

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تاثير فترات الري و معدلات النتروجين علي إ نتاجية المياة ، نمو و محصول الأرز للصنف جيزة ١٧٩تحت طريقة الزراعة بالتسطير

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مركز البحوث و التدريب في الأرز-سخا –كفر الشيخ- معهد بحوث المحاصيل الحقلية –مركز البحوث الزراعية-مصر.

اقيمت تجربتان حقليتان بمحطة بحوث سخا الزراعية بكفر الشيخ –مصر خلال موسمي ٢٠١٢ و٢٠١٣ وتهدف الى تحديد معدلات النتروجين المثلي للارز التسطير تحت فترات ري مختلفة باستخدام الصنف جيزة ١٧٩ وكذلك دور النتروجين في تخيف الأثر الضار لنقص مياة الري.اقيمتالتجارب في تصميم الشرائح المتعامدة في اربعة مكررات . وزعت فترات الري و هي ا لري كل ٣(الغمرالمستمر)،٦و٩ ايام في الشرائح الأفقية اما الشرائح الراسية وزعت بها معدلات النتروجين و هي صفر ،١١٠ ،١٦٥و٢٢٠ كجم نتروجين /هكتار. و يمكن تلخيص النتائج كما يلي ، وجد ان صفات النمو و المحصول ومكوناتة تأثرت معنويا بفترات الري في موسمي الدراسة. مساحة ورقة العلم ودليلمساحةالورقة و محتوي الكلورفيل و طول النبات و عدد الأفرع و السنابل /المتر المربع و عدد الحبوب الممتلئة/السنبلة و وزن الألف حبة و محصول الحبوب طن/ الهكتارو القش طن / الهكتار نفصت بزيادة طول فترات الري حتي ٩ ايام. اما عدد الأيام من الزراعة حتي الطرد والنسبة المئوية للحبوب الفارغة قد ذادت معنويا مع فترة الري كل ٩ ايام. دليل الحصاد لم يتاثر معنويا بفترات الري في موسمي الدراسة . وقد وجد ان المعاملة الغمر المستمر و الري كل ٦ ايام كان علي نفس الدرجة من المعنوية بدون فرق معنوي خصوصا في محصول الحبوب بينما أ ظهرت صفتي عدد السنابل /م٢ وعدد الحبوب الممتلئة/السنبلة نفس المستوى من المعنوية خلال موسم٢٠١٢. اعطت معاملة الري كل ٦ ايام اعلي كفاة استخدام مياة مع توفيركمية من مياة الري تروارحت من ٦,٩٣ - ٥,٧٨ % علي الرغم من ان المعاملة كل ٩ ايام اعطت اكبر قدر من توفير اليماة (١٨,٨ الي ١٩,٥ %)الاانها سجلت اعلي قدر من نقص المحصول و لذا اعطت اقل كفاءة في استخدام المياة.وجد ان جميع الصفات المدروسة تأثرت معنويا بمعدلات النتروجين و ذادت بزيادة معدلات النتروجين حتي اعلي معدل نتروجين وهو ٢٢٠ كجم نتروجين/هكتار بدون فرق معنوي مع المعدل ١٦٥ كجم نتروجين /هكتار في كلا الموسمين .وجد ايضا ان النسبة المؤية للحبوب الفارغة قلت معنويا مع زيادة معدلات النتروجين حتي ١٦٥ كجم /هكتار و لكن بدات تزيد عند اعلي معدل بدون فرق معنوي مع المعدل المذكور سابقا. وجد ايضا ان كفاءة استخدام المياة قد ذادت بزيادة معدلات النتروجين. وجد ان التفاعل بين عوامل الدراسة اثر معنوي علي مساحة ورقة العلم و دليل مساحة الأوراق و طول النبات و عدد الأفرع و السنابل م-٢ و عدد الحبوب الممتلئة بالسنبلة و النسبة المئويةللحبوب الفارعة و وزن الألف حبة و محصول الحبوب و القش في كلا موسمي الدراسةبينما لم تتاثر صفة عدد الايام من الزراعة حتي الطرد ،محتوى الكلوروفيل ودليل الحصاد بالتفاعل بين عوامل الدراسة في كلا الموسمين. و جاءت نتائج التفاعل لتؤكد افضلية الري كل ٦ ايام مع ١٦٥ كجم نيتروجين هكتار$^{-١}$ ،حيث اعطت اعلي كفاءة في استخدام مياةالري ودون نقص في محصول الحبوب. كان لزيادة معدلات الأزوت تحت فترات الري الطويلة اثرا معنويا في تخفيف الاثر الضار الناتج من نقص المياة علي نمو و محصول الأرز التسطير و كفاءة استخدام المياة.

يمكن التوصية بالري كل ستة ايام واضافة معدل النتروجين ١٦٥ كجم هكتار$^{-١}$ للحصول علي اعلي قدر من توفير المياة و معدل عالي من كفاءة استخدام المياة. وايضا في حالة تطويل فترات الري الي ٩ ايام كما هو سائد في نهايات الترع يمكن زيادة معدلات النتروجين لتكون ٢٢٠ كجم هكتار$^{-١}$ مع الأرز التسطير لضمان محصول عالي و اعلي عائد من وحدة الأرض و المياة.