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Corn Yield Response to Nitrogen Fertigation at Different Configurations of Bubbler Irrigation System

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ABSTRACT

This work meant to concentrate on the impact of bubbler water system circuits (BIS) and nitrogen (N) treatment on vegetative development, yield boundaries and NPK substance in corn crops. To accomplish this reason in the field, explore for two developing seasons 2019-2020 and 2020-2021 were led on sandy soil at the Experimental Farm of National Research Center, Research and Production Station, ElNoubaria, El-Behaira Governorate. A field explore was organized as a factorial trial dependent on a randomized total square plan with three duplicates. First component was nitrogen preparation rates (NFR) which were added at three rates (50, 70, 90 kg Fed-1) (Feddan [Fed] = 4200 m2). The subsequent element was bubbler water system circuits (BIS) which were executed at three frameworks) one complex for horizontal lines or shut circuits with one complex of the bubbler water system framework (CM1BIS); 2) shut circuits with two manifolds for sidelong lines (CM2BIS), and 3) customary bubbler water system framework (TBIS) as a control. Acquired outcomes uncovered that the impact of various BIS and NFR on NPK substance in corn grain. The impact of connection BIS X NFR on vegetative development, yield boundaries, and NPK (%) in corn grain referenced above was huge at the 1% level with not many exemptions. Worried to vegetative development and yield boundaries, BIS and NFR utilized could be positioned in the accompanying climbing orders: TBIS < CM2BIS < CM1BIS and NFR3 < NFR2 < NFR1, individually for every concentrated on boundary.

Key words: Irrigation system, Bubbler, Nitrogen, Closed circuits, Corn, Yield.

INTRODUCTION

Egypt has plans to utilize its restricted water assets proficiently and defeat the hole among organic market. In the old grounds of the Nile Valley and Delta, most ranchers actually utilize crude strategies for water system, preparation, and weed and nuisance control rehearses. The conventional treatment (adding composts manually) is low proficiency, and results in greater expenses and ecological issues, (Abou Kheira, 2009). He added that Corn (Zea Mays L.,) is quite possibly the main cereal, both for individuals and creature utilization, in Egypt and is developed for both grain and rummage. The inquiries regularly emerge, "What is the base water system limit with regards to flooded transgenic corn? also, what is the reasonable water system framework for inundating transgenic corn?" These are questions that is extremely difficult to reply, since they enormously rely upon the climate, yield objective, soil type, region conditions and the important financial conditions for productivity.

The water system water prerequisites of maize waver from 500 until 900 m3 for accomplishment of greatest creation by an assortment of medium development of seeds (Doorenbos and Kassam, 1986). On a coarse surface soil, maize creation expanded with a blend of profound culturing and the overall expansion in crop water system (Gill et al., 1996). Other examination researchers Filintas et al., (2006, 2007), Dioudis et al., (2008), Mansour (2015) and Mansour et al. (2014) Mansour et al., (2013), Mansour et al., (2014), Ibrahim et al. 2018 and Mansour and Aljughaiman 2012, 2015, Mansour and El-Melhem 2012, 2015; Attia et al 2019 and Pibars et al. 2015, 2019) made a broad water system study in the development of maize, they found a similar end for example water system is absolutely critical, from the presence of the primary silk strands until the smooth stage in the development of the portions on the cob. When the smooth stage was happened, the presence of dark layer advancement on 50 % of the maize parts is an indication that the yield has completely aged. The previously mentioned models were utilized in the test plot for the absolute water system process.

Most examination projects regarding this matter allude with the impact of water system on corn yield utilizing sprinkler water system or wrinkle water system. Conversely, a couple of studies have been made on maize development under bubbler water system (Eldardiry et al. (2015), Abd-Elmabod et al. (2019), Goyal and Mansour (2015) and El-Hagarey et al. (2015), Mansour et al. (2015a-f), (2019a,b) and (2016a-c), Filintas et al., 2006a; Filintas et al., 2007 and Dioudis et al.,2008, Mansour 2006, 2010a, 2010b, 2012, 2013, Mansour et al., 2013, Mansour et al., 2014, Mansour et al., 2015a, Mansour et al., 2015b). These couple of studies utilized the vanishing dish technique to compute the measure of water prerequisite for water system. This technique was utilized in England, in 2001, for water system planning in up to 45 % of the inundated spaces of the country in outside development, (Weatherhead and Danert, 2002).

Likewise, an extra benefit of bubbler water system is that, there are many devices accessible for soil dampness estimation (Cary and Fisher, 1983; Filintas, 2005), electronic software engineers and electrohydraulic components which give the chance of complete mechanization of water system organizations (Charlesworth, 2000; Filintas, 2005).

Abd El-Hafez et al., (2008) reported that the highest values of grain yield were obtained with irrigation at 1.3 ETc as compared to 1 and 0.7 ETc. While, Abdel-Maksoud et al., (2008) reported that the highest (67.96 and 68.87cm) and lowest (56.45 and 57.13 cm) ETc values in both seasons were obtained with increasing irrigation intervals from 7 to 21 days intervals, respectively. El-Sabbagh et al., (1997) Tayel et al. (2012a,b), (2015a-e), (2016), (2018), (2019) found that treatment which irrigated at 80% of the field capacity obtained the highest values of ear length, ear weight, number of kernel row-1, 100-kernel weight and grain yield fed-1. Also, they found that values of water consumptive use were 69.41, 58.30 and 46.68 cm for the treatments irrigated at 80% 65% and 50% of field capacity, respectively. El-Mowelhi et al., (1999) found that under drip irrigation increasing intervals from 4 to 7 days significantly decreased ear character and maize grain yield fed-1. Also, they found that furrow irrigation reduced water productivity (kg maize grain yield m3 of water consumed or m3 of water applied) by 15.89 and 30.61% respectively, as compared with drip irrigation system. Further, fertilizer application is the most important factor of increasing yield per unit area.

Nitrogen is considered as one of major nutrients required by the plants for growth, development and yield (Singh et al., 2003). AbdelMawly and Zanouny (2005) reported that N and K fertilizer applications had significant effect on yield of Zea maize. Ma and Subedi (2005) found a positive effect of all N treatment over the control regarding yield in Zea maize. Wajid et al., (2007) reported that an increase in nitrogen application resulted in maximum stem length, 100-grain weight and grain yield of Zea maize. Camilia, et al (2013) added that the high concentration of salts in the soil solution may reduce the absorption of nitrogen, phosphorus and potassium so it is necessary to add these elements in the form of fertilizers. Understanding the mechanisms by which salinity affects photosynthesis and other physiological processes would help to improve conditions for growing vegetables and increase their yield and quality, and would provide a useful tool for future genetic engineering.

The aim of the work presented in this paper is studying the effect of bubbler irrigation circuits (BIS) used: 1- Closed irrigation circuit with one manifold for lateral lines (CM1BIS) 2- Closed irrigation circuit with two manifolds for lateral lines (CM2BIS), 3- traditional bubbler irrigation system (TBIS) as a control and nitrogen fertilizers rates (NFR): (NFR1 = 50 kgfed-1, NFR2 = 70 kgfed-1, NFR3 = 90 kgfed-1) on: Vegetative growth, yield parameters and N, P and K (%) in corn grain.

MATERIALS AND METHODS

Field test were conveyed at the Experimental Farm of National Research Center, Research and Production Station, ElNoubaria, El-Behaira Governorate at scope 30° 30' 1.4" N, longitude 30°19' 10.9" E, and mean elevation 21 m above ocean level during two progressive season 2019-2020 and 2020-2021 . The test plan of field tests was parted randomized total square plan with three recreates. Lab earlier tests were directed on three nitrogen (N) rates 50, 70, 90 kg took care of 1 under the accompanying three bubbler water system circuits (BIS) of: a) One complex for parallel lines or shut circuits with one complex of bubbler water system framework (CM1BIS); b) Closed circuits with two manifolds for sidelong lines (CM2BIS), and c) Traditional bubbler water system framework (TBIS) as a control, Details of the strain and water supply control have been depicted by Safi et al., (2007). Lab tests were done to determine the issue of absence of strain head toward the finish of parallel lines in the TBIS. Soil exture of test field was sandy soil (Gee and Bauder, 1986) and dampness maintenance as indicated by (Klute, 1986). Soil substance attributes of soil glue immersion concentrate and water system water investigation are displayed in Tables (1, 2; 3) (Rebecca, 2004).

Table 1. Some chemical properties of irrigation water.

pH	EC dS/m	Soluble cations, meq/L				Soluble anions, meq/l				SAR
		Ca++	Mg++	Na+	K+	CO3--	HCO3-	SO4--	Cl--	
7.8	0.34	0.71	0.23	2.45	0.9	0	0.94	0.31	3.04	3.57

Table 2. Some physical properties of soil in the experimental farm.

Depth Cm	Particle Size distribution, %				Texture Class	θS % on a weight basis			HC (cm h-1)	BD (g/cm³)	P (cm³ voids /cm³ soil)
	C. Sand	F. Sand	Silt	Clay		F.C.	P.W.P.	A.W			
0-15	9.90	76.4	8.4	5.30	Sandy	12.0	4.0	8	6.55	1.65	0.34
15-30	9.80	76.2	8.3	5.70	Sandy	12.0	4.0	8	6.75	1.65	0.34
30-45	9.40	76.6	8.60	5.4	Sandy	12.0	4.0	8	6.81	1.65	0.35
45-60	9.40	76.7	8.50	5.4	Sandy	12.0	4.0	8	6.57	1.65	0.36

* Particle size distribution after [43] (Gee and Bauder, 1986) and Moisture retention after [44] (Klute, 1986) F.C.: Field Capacity, W.P.: Wilting Point, AW: Available Water, HC: Hydraulic conductivity (cm h-1), BD: Bulk density (g/cm3) and P: Porosity (cm³ voids/cm³ soil).

Table 3. Some chemical properties of soil in the experimental farm.

Depth,	pH	EC	Soluble Cations, meq/L				Soluble Anions, meq/L			
Cm	01:02.5	dS/m	Ca++	Mg++	Na+	K+	CO3--	HCO3-	SO4--	Cl -
0-15	7.9	0.4	0.55	0.37	1.04	0.25	0	0.14	0.81	1.26
15-30	7.9	0.41	0.5	0.44	1.04	0.24	0	0.15	0.84	1.23
30-45	8.1	0.41	0.54	0.41	1.05	0.22	0	0.15	0.84	1.23
45-60	8.3	0.49	0.58	0.59	1.04	0.22	0.18	0.14	0.86	1.25

Water system networks incorporate the accompanying parts are: 1. Control head: It was situated at the water source supply. It comprises of outward siphon 3"/3", driven by electric motor (siphon release of 90 m3 h-1 and 50 m lift), sand media channel 48"(two tanks), screen channel 2" (120 cross section), reverse avoidance gadget, pressure controller, pressure checks, flowmeter, control valves and synthetic infusion, 2. Primary line: PVC lines of 75 mm in (ID) Ø to pass on the water from the source to the principle control focuses in the field, 3. Sub-primary lines: PVC lines of 75 mm in (ID) Ø were associated with the principle line through a control unit comprises of a 2" ball valve and tension measures, 4. Complex lines: PVC lines of 50 mm in (ID) Ø were associated with the sub principle line through control valves 1.5", 5. Parallel lines: PE containers of 16 mm in (ID) Ø were associated with the manifolds through beginnings slowed down on manifolds lines, 6. Producers: These producers (GR) worked in PE tubes 16 mm in (ID) Ø, producer release of 4 lh-1 at 1 atm. ostensible working tension and 30 cm dispersing in the middle.

The parts of shut circuits of the bubbler framework incorporate, supply lines, control valves, supply and return manifolds, bubbler parallel lines, producers, check valves and air help valves/vacuum breakers

The stream rate through the line put relies upon pipe surface harshness and air layer obstruction. The difference in water driven rubbing coefficient esteems, contingent upon varieties in Re number qualities. Water driven misfortunes at plastic lines may be determined as misfortunes at powerfully smooth lines, duplicated by remedy coefficients that evaluate misfortunes at pipe joints and air obstruction.

Water system planning: Intervals of water system (I) in day were determined utilizing the accompanying conditions:

I = d/ETc … … … … … .… … .… … … (1) where: d = net water profundity applied per every water system (mm). And so on = crop evapotranspiration (mm/day).

d = AMD . ASW . Rd . P … … … … … … .. (2)

where:

AMD = admissible soil dampness consumption (%).

ASW = accessible soil water, (mm water/m profundity). Rd = viable root zone profundity (m), or water system profundity (m), p = level of soil region wetted (%).

AW(v/v %) = ASW(w/w %) . B. D … … … … .… .. (3) where:

B. D. = Soil mass thickness (gm cm-3).

Water system stretch utilized was 4 days under both shut circuits and conventional bubbler water system frameworks.

The (ETc) was registered utilizing the Class A Pan dissipation strategy for assessing (ETo) on regular schedule accepted from closest meteorological station as appearing in Table (4). The altered container dissipation condition to be utilized:

ETo= Kp.Ep … … … … … … … … ..… .. (4) where:

ETo = reference evapotranspiration [mm day-1], Kp= dish coefficient of 0.76 for Class A container put in short green trimmed and medium breeze region.

Ep= day by day dish dissipation (mm day-1), Seasonal normal is [7.5 mm day-1] (Allen et al., 1998).

The reference evapotranspiration (ETo) is then duplicated by a harvest coefficient Kc at development stage to decide crop immoderate use at that phase of maize development.

ETc= ETo.Kc … … ..… … … … ..… … ..… … ..(5)

The decrease factor (Kr) was determined utilizing Eq. 26.

Kr = GC + ½ (1 - GC) … … … … .… … … … (6) where:

GC = ground cover rate.

Water system effectiveness (Ea) determined by

Ea =Ks. Eu … … … … … … … … .… ... (7) where:

Ea = Irrigation effectiveness

Eu = discharge consistency (%) and

Ks = decrease variable of soil wetted.

The gross water system water necessities IWRg (mm profundity):

IWRg = IWRn .Ea + Lr … … … … … … .… … (8) where:

IWRg = the gross water system water necessities, IWRn = the net water system water prerequisites Lr = the additional measure of water required for filtering.

The distance between lines was 0.7 m and 0.25 m between plants in the line. Each column was watered by a solitary straight parallel line in the shut circuits and customary bubbler water system plots.The corn was planted and irrigaton began on April, ninth in the first season and on April, twelfth in the second season, water system period of corn was finished 11 days before reap. Corn was reaped on September 15. Plants densities were 35700 plants for each took care of as per (ISU), Northeast Research and Demonstration Farm.

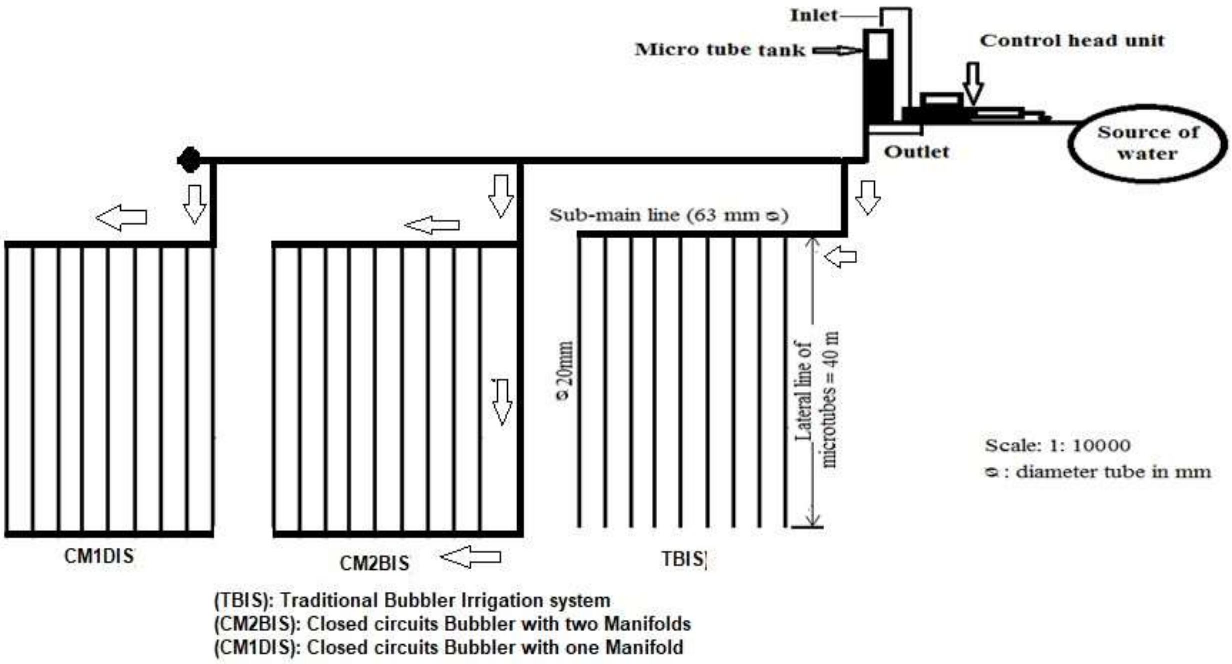


Fig. 1: Layout of closed circuits design of bubbler irrigation systems

Treatment program was finished by the suggested portions all through two developing seasons for dry spell resilience of corn crop under the examined water system frameworks utilizing fertigation method. These measures of manures three urea nitrogen (N) rates 50, 70, 90 kg took care of 1 and the suggested NPK (20-20-10), were 74. 6 kg .took care of 1 of (20 % N), 33.0 kg.fed-1 of (20 % K2O) and 70.5 kg.fed-1 of (10 % P2O5) on multiple times through developing season special case from 11 days before gather.

Parts of yield or estimated incorporate plant tallness (cm), leaf length (cm), leaf region (cm2), number of leaves per plant, complete grain weight (Kg.fed-1) and Stover yield (Kg.fed-1). Plant estimations and perceptions were begun 21 days in the wake of planting and were ended on the collect date. All plant tests were dried at 65°C until consistent weight was accomplished. Grain yield was dictated by hand reaping the 8 m areas of three contiguous focus columns in each plot was acclimated to 15.5% water content.

In the entirety of treatment's plots, the grain yields of individual not set in stone to assess the yield consistency among the columns.

Table 4: Water requirements for corn grown at El-Noubara, Elbehaira, 2017

Month	Apr	May	Jun	Jul	Aug	Sep
Epan (mm/day)	6.34	6.92	7.97	9.59	9.32	7.17
Kp	0.76			--		
Kc	1.05	1.08	1.15	1.17	1.22	1.25
Kr	0.45	0.9	0.95	1	1	1
ETo (mm/day)	4.74	5.26	6.06	7.29	7.09	5.45
ETc (mm/day)	2.24	5.12	6.62	8.53	8.65	6.82
Ks	--100% (1.00)-----------------------					
Eu	---90% (1.11)--------------					
Lr	---10%-----------------------					
Growth stage Planting(Establishment)		Vegetative		Flowering	Ribbing yield Harvesting	
Length of growth stage	9-30Ap.	1 M-12 Jun		13Jun-28Jul	29 Jul-15 Sep.	
Number of Days (Irri. season)	22	43	46	46		38
IRg (mm/month)	49.3	158.8	198.6	264.5	268.2	27.3
IRn (mm/month)	50.7	131.1	164.2	218.6	221.7	22.6

MSTATC program (Michigan State University) was utilized to complete factual investigation. Medicines mean were analyzed utilizing the strategy of investigation of change (ANOVA) and the most un-huge contrast (L.S.D) between frameworks at 1 %. (Steel and Torrie, 1990).

RESULTS AND DISCUSSION

Table 5 and figures (1:3) showed the fundamental one of bubbler water system circuits (BIS) and sub-primary one of the nitrogen compost rates (NFR) on some vegetative development and yield boundaries of transgenic and non-transgenic corn. Estimated boundaries were leaf region (cm2), plant stature (cm), leaf length (cm), number of leaves, grain yield (ton/took care of) and Stover yield (ton/took care of). Table (5) and Fig. (2) showed the impact of various BIS and NFR on Leaf Area. Information could be positioned in the accompanying slipping request: CM2BIS > CM1BIS > TBIS. Concerning the Leaf Area, results achieved demonstrated critical contrasts among implies upsides of both fundamental impacts BIS and sub-principle impact NFR. As indicated by the impact of association between both researched factors, the most noteworthy and least upsides of Leaf Area were recorded at CM2BIS and NFR1. Moreover, information saw that under all BIS, all most elevated qualities were seen at NFR1. Information in Table (5) and plotted in Fig. (2) show that a similar pattern of Leaf Area plant tallness (plant stature) took. The impact of BIS and NFR could be positioned in the accompanying plunging orders: CM2BIS > CM1BIS > TBIS and NFR1> NFR2> NFR3, separately. Contrasts in plant stature were critical at 1 % level among all means upsides of NFR. Likewise, contrasts inside upsides of BIS treatment were critical at the 1% level aside from that somewhere in the range of CM2BIS and CM1BIS. The impact of cooperation between two concentrated on factors were critical at the 1 % level besides in the accompanying associations: CM2BIS X NFR3, CM1BIS X NFR2, CM1BIS X NFR3 and TBIS X NFR3. The greatest and least upsides of plant tallness were found in the connections of NFR1 X CM2BIS and NFR3 X TBIS, individually. Information of Table 5 and Fig. 3 delineated the impact of various CM1BIS>CM2BIS>TBIS and NFR1≥NFR2>NFR3, BIS and

NFR on leaf length (cm). As indicated by NFR, BIS individually. furthermore, NFR could be positioned in the accompanying slipping requests:

Table 5: Effect of bubbler irrigation circuits designs and nitrogen fertilizers rates on corn plants growth and yield

ICB	NFR (kg.fed-)	Growth and Yield Characteristics at Harvest(average) Leaf area (cm^2)	Plant height (cm)	Leaf length (cm)	No. of leaves per plant	Yield ($ton.fed^{-1}$) Grain	Stover
CM2BIS	90	497.17	191.22	65.95	14.11	4.99	3.10
	70	488.97	189.65	64.29	13.98	4.72	3.05
	50	485.81	190.19	62.69	13.81	4.63	3.00
CM1BIS	90	495.87	190.74	64.65	13.63	4.88	3.08
	70	482.77	190.29	63.78	13.44	4.63	3.02
	50	477.27	188.97	61.86	13.32	4.57	3.08
TBIS	90	493.79	190.10	64.02	13.52	4.63	3.06
	70	484.22	189.27	63.17	13.38	4.22	2.99
	50	475.75	188.89	61.70	13.21	3.96	3.08
ICB X NFR	LSD 0.05	0.45	0.06	0.03	0.02	0.01	0.01
ICB Means	CM2BIS	490.65	190.35	64.31	13.96	4.78	3.05
	CM1BIS	485.30	190.00	63.43	13.46	4.69	3.06
	TBIS	484.58	189.42	62.96	13.37	4.27	3.04
	LSD 0.05	2.11	0.08	0.07	0.04	0.02	0.01
NFR Means	90	495.61	190.69	64.87	13.75	4.83	3.08
	70	485.32	189.74	63.75	13.60	4.52	3.02
	50	479.61	189.35	62.10	13.45	4.39	3.05
	LSD 0.05	1.46	0.16	1.23	0.32	0.11	0.01

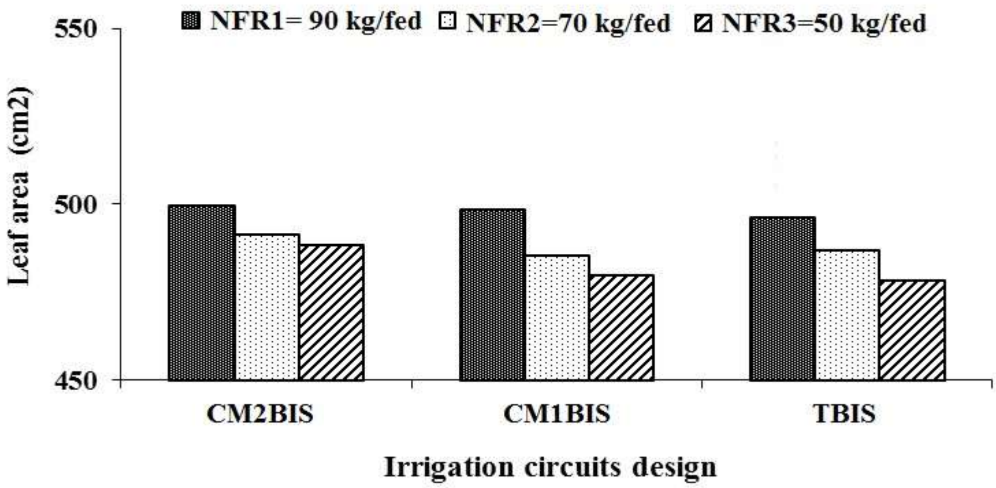


Fig. 2: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on leaf area of corn plants.

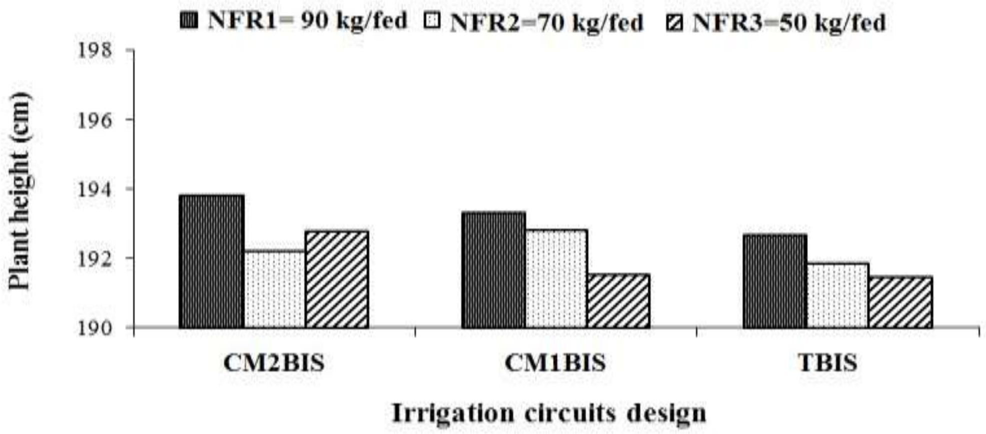


Fig. 3: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on plant height of corn plants.

Worried to the NFR information demonstrated that there is critical contrast inside principle impact (BIS), while the most noteworthy and the least qualities were recorded at CM1BIS and TBIS, separately. Though there is critical contrast inside NFR medicines, besides somewhere in the range of NFR1 and NFR2 at the 5% level. The most noteworthy worth was recorded at NFR1 and the least one was recorded at NFR3 treatment. The impact of cooperation among the two review factors, information showed that there were huge contrasts between medicines at the 5% level. The most extreme and least upsides of NFR were recorded at CM2BIS; NFR1 and TBIS; NFR3. Table (5) and Fig. (4) demonstrated the impact of BIS and NFR on LN per plant, it very well may be positioned in after slipping order: CM2BIS>CM1BIS>TBIS. Contrasts in LN per plant between method for the two variables considered were critical at the 5% level. While the most noteworthy and least qualities under BIS and NFR were accomplished at CM2BIS; TBIS and NFR1; NFR3, separately. The greatest and least upsides of LN plant-1 were (altogether at 5%) recorded at CM2BIS X NFR3 and TBIS X NFR1, separately. The prevalence of the concentrated on development boundaries under (CM2BIS; CM1BIS comparative with TBIS) and (NFR1; NFR2 comparative with NFR3) can be seen this prevalence was expected over working on both water and composts conveyance consistency.

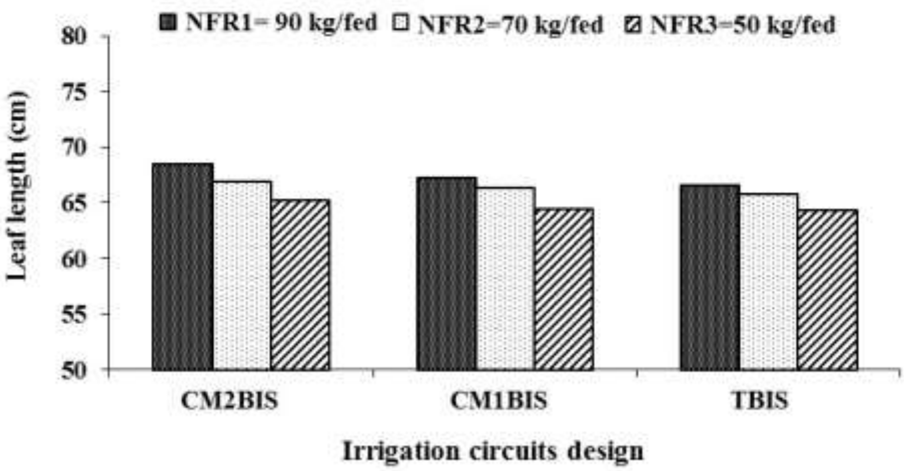
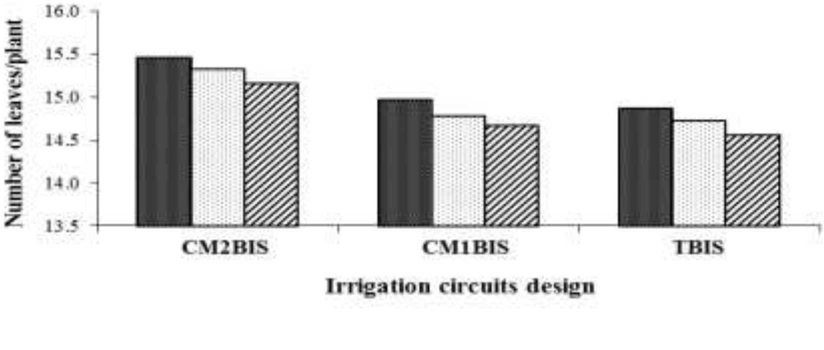


Fig. 4: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on leaf length of corn plants.



5: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on number of leaves per plant of corn.

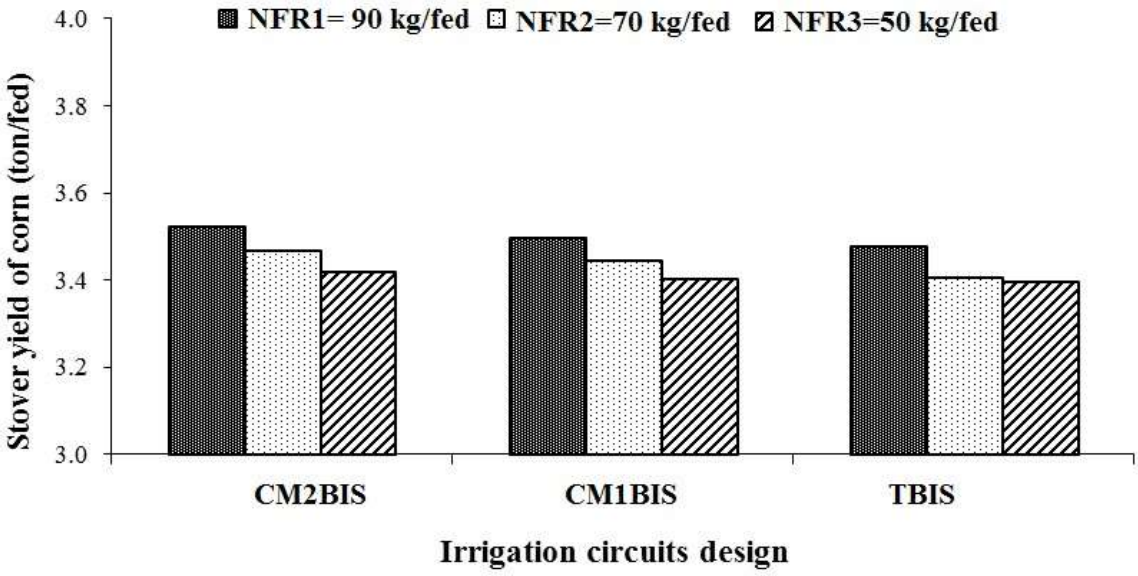


Fig. 6: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on corn Stover yield.

Information in Table (5) and Fig. (6) demonstrated the impact of BIS and NFR on corn GY (ton/took care of), both could be positioned in the accompanying climbing orders: TBIS < CM1BIS < CM2BIS and NFR3< NFR2<

NFR1, separately. In regard to the fundamental impact of (BIS) on GY, one can see that, the distinctions in GY were critical among all BIS at the 5% level. The most noteworthy and least GY were acquired in CM2BIS and TBIS, separately. As indicated by GY, the impact of NFR on GY, there is critical contrasts at the 5% level between NFR1, NFR2; NFR3, at whatever point most noteworthy and least qualities were accomplished under NFR1 and NFR3, individually. Concerning the impact of BIS X NFR on GY, there were critical contrasts at the 5% level, besides at the accompanying associations: CM2BIS X NFR3, TBIS X NFR1, CM2BIS X NFR3 and CM1BIS X NFR2. The greatest and least upsides of GY were acquired in CM2BIS X NFR1 and TBIS X NFR3, separately.

We can see that the transgenic and non-corn GY took similar pattern of other vegetative development boundaries, and this finding could be ascribed to the nearby relationship between's vegetative development from side and grain yield from the other one.

Table (5) and Fig. (7) demonstrated the impact of both (BIS) and (NFR) on SY (ton/took care of). We can see that the adjustment of SY took similar pattern of vegetative development boundaries and consequently took the pattern of GY additionally because of past reasons referenced previously.

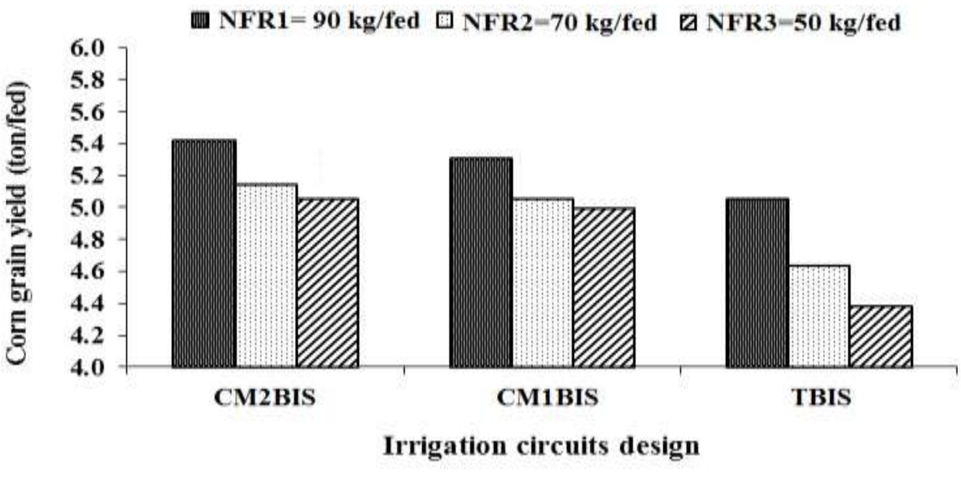


Fig. 7: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on corn grain yield.

Concerning the constructive outcome of (BIS and NFR) on SY, they could be positioned in after plunging orders: CM2BIS > CM1BIS > TBIS and NFR1> NFR2>NFR3. In regard to (BIS and NFR) impact on the SY, one can see huge distinction at the 5% level between all means upsides of BIS and NFR. As per the cooperation impact of the explored factors, the most noteworthy worth of SY was gotten at CM2BIS X NFR1. While the most minimal one was accomplished at TBIS X NFR3, separately. Information of Table 6 and Figures (8:10) delineated the impact of various BIS and NFR on N (%), P (%) and K (%) in grain corn. As per BIS and NFR could be positioned in the accompanying dropping requests: CM1BIS>CM2BIS>TBIS and NFR1≥NFR2>NFR3, separately.

Worried to the NFR information showed that there is critical contrast inside primary impact (BIS), while the most elevated and the least qualities were recorded at CM1BIS and TBIS, individually. While there is critical contrast inside NFR medicines, besides somewhere in the range of NFR1 and NFR2 at the 5 % level. The most noteworthy worth was recorded at NFR1 and the least one was recorded at NFR3 treatment. The impact of connection among the two review factors, information showed that there were huge contrasts between medicines at the 5% level. The most extreme and least upsides of NFR were recorded at CM2BIS; NFR1 and TBIS; NFR3.Table 6: Effect of bubbler irrigation circuits designs and nitrogen fertilizers rates on NPK in grain corn.

ICB	NFR	N%	P%	K%
CM2BIS	90	2.45	0.31	0.24
	70	2.39	0.23	0.23
	50	2.12	0.20	0.19
CM1BIS	90	2.60	0.36	0.29
	70	2.48	0.28	0.26
	50	2.33	0.23	0.21
TBIS	90	2.37	0.25	0.25
	70	2.32	0.23	0.22
	50	2.06	0.18	0.17
ICBXNFR	LSD 0.05	0.02	0.03	0.01
ICB Means	CM2BIS	2.31	0.25	0.22
	CM1BIS	2.47	0.29	0.25
	TBIS	2.25	0.22	0.21
	LSD 0.05	0.05	0.02	0.02
NFR Means	90	2.47	0.31	0.26
	70	2.39	0.25	0.24
	50	2.17	0.2	0.19
	LSD 0.05	2.08	0.02	0.03

Table (6) and Figures (8:10) showed the impact of BIS and NFR on N (%), P (%) and K (%) in grain corn, it very well may be positioned in after sliding request: CM2BIS > CM1BIS > TBIS. Contrasts in N (%), P (%) and K (%) in grain corn between method for the two elements contemplated were huge at the 5% level. While the most elevated and least qualities under BIS and NFR were accomplished at CM2BIS; TBIS and NFR1; NFR3, individually. The most extreme and least upsides of N (%), P (%) and K (%) in grain corn were (fundamentally at 5%) recorded at CM2BIS X NFR3 and TBIS X NFR1, separately. The predominance of the concentrated on development boundaries under (CM2BIS; CM1BIS comparative with TBIS) and (NFR1; NFR2 comparative with NFR3) can be seen this prevalence was expected over working on both water and manures dissemination consistency.

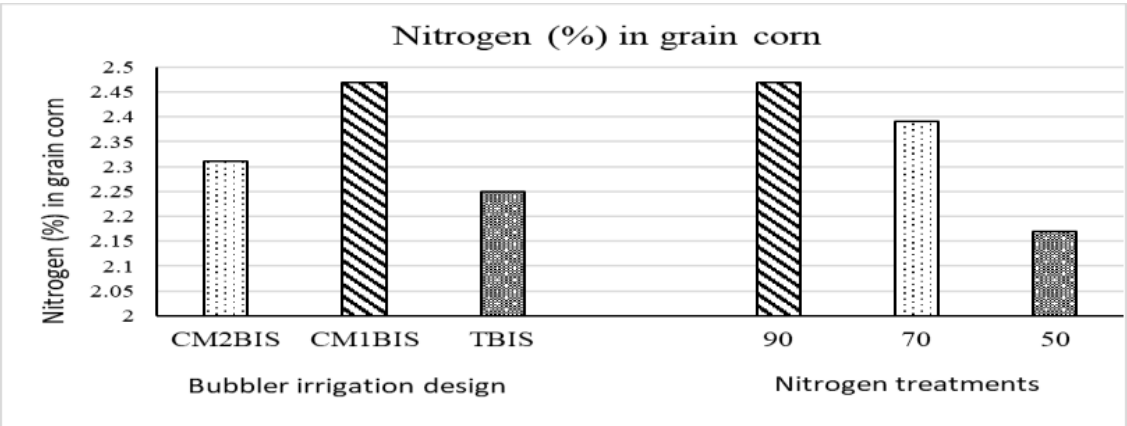


Fig. 8: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on nitrogen percentage in grain corn.

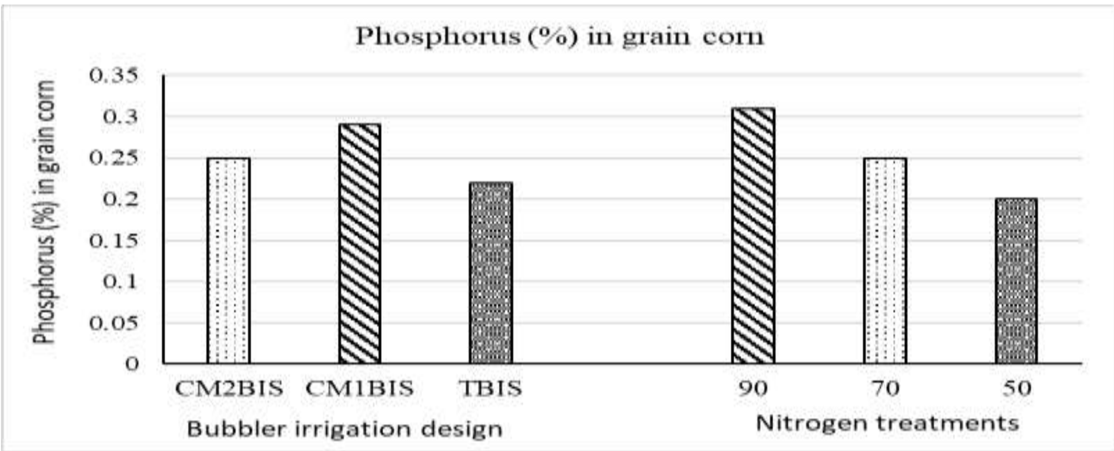


Fig. 9: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on phosphorus percentage in grain corn.

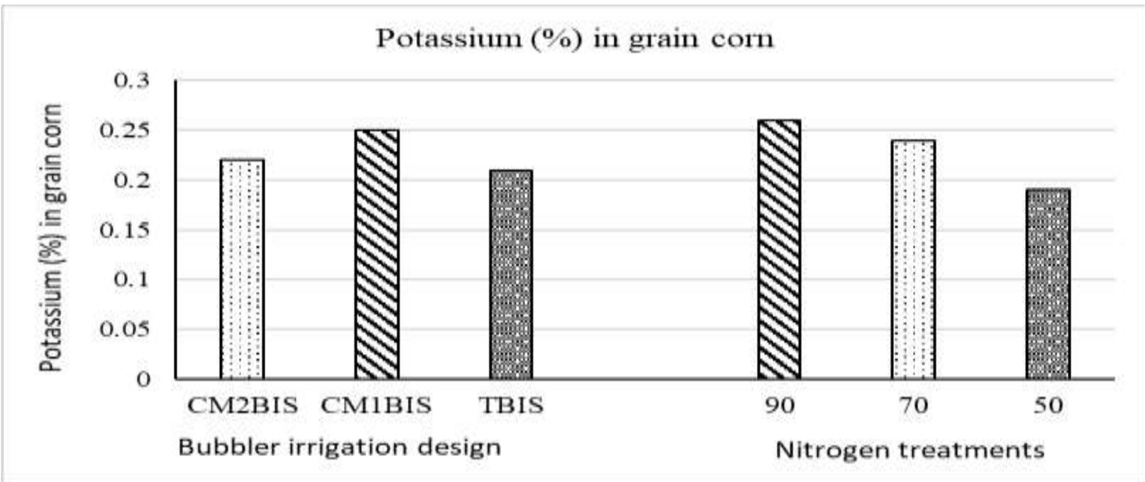


Fig. 10: Effect of different bubbler irrigation circuits designs and nitrogen fertilizer rates on potassium percentage in grain corn.

CONCLUSION

Information available could be summed up as follow:

1-Concerning to vegetative development and yield boundaries (leaf region (cm2), plant tallness (cm), leaf length (cm), number of leaves/plant, grain and Stover yield (Kg/took care of), BIS and NFR utilized could be positioned in the accompanying rising requests: TBIS < CM2BIS < CM1BIS and NFR3 < NFR2 < NFR1, separately for every single concentrated on boundary.

2-The impact of communication BIS X NFR on vegetative development and yield boundaries referenced above was critical at the 1% level with not many exemptions. The most noteworthy upsides of leaf region (cm2), plant tallness (cm), leaf length (cm), number of leaves/plant; grain and Stover yield (Kg/took care of) were 499.73 cm2, 193.78 cm, 68.51 cm, 15.45, 5.41 ton/took care of; 3.52 ton/took care of and the least ones (478.31 cm2, 191.45 cm, 64.26 cm, 14.55, 4.38 ton/took care of; 3.50 ton/took care of) could be found in the communications: CM2BIS X NFR1 ; TBIS X NFR3, individually.

3-The impact of various BIS and NFR on N , P and K substance (%) in grain corn. As per BIS and NFR could be positioned in the accompanying plummeting orders: CM1BIS > CM2BIS > TBIS and NFR1 ≥ NFR2 > NFR3, individually.

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