Int.J.Curr.Microbiol.App.Sci (2017) *6*(5): 52-60

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 5 (2017) pp. 52-60**
Journal homepage: http://www.ijcmas.com

EXCELLENT PUBLISHERS

Original Research Article https://doi.org/10.20546/ijcmas.2017.605.007

Response of Land Configuration and Deficit Irrigation on Growth and Yield Attributes of Maize (*Zea mays* L.)

Hanamant M. Halli* and S.S. Angadi

Department of Agronomy, University of Agricultural Sciences, Dharwad-580005 (Karnataka), India
**Corresponding author*

Keywords

Ridges and furrow, corrugated furrow, Broad bed and furrow, depletion of available soil moisture (DASM) and maize.

Article Info

Accepted:
04 April 2017
Available Online:
10 May 2017

A B S T R A C T

The field experiment was conducted during summer 2015 and 2016 under irrigated condition to study the effect of land configurations and deficit irrigation on maize at the Main Agriculture Research Station, University of Agricultural Sciences, Dharwad, Karnataka. The treatments include land configurations (Broad bed and furrow; BBF, corrugated furrow and ridges and furrow methods) and irrigation levels (Irrigation once in ten days, irrigation at 40, 50 and 60 per cent depletion). Results revealed that, ridges and furrow (70.6 q ha^{-1}) and corrugated furrow method (68.9 q ha^{-1}) produced significantly higher and on par grain yield as compared to BBF method of planting (60.9 q ha^{-1}). Whereas, irrigation at 50 per cent (69.7 q ha^{-1}) and 40 per cent (69.6 q ha^{-1}) depletion recorded significantly higher and at par grain yield over other irrigation levels. The combined effect of corrugated furrow method with irrigation at 50 depletion (grain yield of 74.9 q ha^{-1}) and ridges and furrow method with irrigation at 40 (grain yield of 72.8 q ha^{-1}) as well as irrigation at 50 per cent depletion significantly enhanced the growth and yield attributes as compared to the rest of the treatment combinations. BBF method with irrigation at 60 per cent depletion recorded significantly lowest growth and yield parameters of maize.

Introduction

Maize (*Zea mays* L.) is the third most important diversified and high potential cereal crop (after wheat and rice) and is grown throughout a wide range of climates. It is desired for multiple purposes as human food, animal feed, pharmaceutical, industrial manufacturing, corn syrup and oil, hence it is gradually replacing other crops too. The major producers are USA followed by China, Brazil, Argentina and India. In India it occupied an area of 9.5 m ha with production of 25 m t and the productivity of 2500 kg ha^{-1}, which is less than half of the world productivity.

In India maize accounts for 10 per cent of the total food grain production, its area and production are increasing gradually in both irrigated and rainfed area because of multiple demands and better market price (Anon., 2015a).

The productivity of any crop is the complex phenomenon and governed by number of factors viz., use of improved genotypes, appropriate time and method of sowing and judicious use of water as well as nutrients and other management practices. However, appropriate agronomic management practices like suitable land configuration and regulated water usage are the most critical factors for realizing desired yield potential with higher resource use efficiency (Deshmukh *et al.*, 2016).

Land configurations is important for better growth and development of any crop and decides the effectiveness of the crop management practices, regarding application of nutrient, irrigation water, weed management, *etc*. They have an impact on the crop growth by influencing the soil moisture availability, aeration, root growth, crop lodging and nutrient availability. Deficit irrigation practices irrigate the entire crop root zone with less amount of water than the conventional method of irrigation. The mild stress has minimal effects on the crop yield and expected to trigger different water stress mechanisms in crop. Irrigating crops with desirable depletion is not practiced which leads to excessive use of water than the crop requirement.

Materials and Methods

The field experiment was conducted during summer 2015 and 2016 at the Main Agriculture Research Station, University of Agricultural Sciences, Dharwad (Karnataka), situated at 15°26' N latitude, 75°07' E longitude and at an altitude of 678 m above mean sea level. The research station comes under Northern Transition Zone (Zone-8) of Karnataka. The soil type of the experimental site was medium black (*vertisols*) and clayey in texture. The soil was neutral to slightly alkaline in reaction (7.83) with normal in electrical conductivity (0.24 dS m^{-1}), medium in organic carbon content (0.62 %), medium in available of nitrogen (320.3 kg ha^{-1}) and phosphorus (33.21 kg ha^{-1}) and high in available potassium (426.5 kg ha^{-1}). The bulk density of top soil (30 cm) was 1.24 g cc^{-1}. The soil moisture content at field capacity was 32.40 per cent and permanent wilting point was 18.00 per cent in the upper 0 to 30 cm surface. The total rainfall received during maize growing period varied with respect to amount and intensity (February to May) and was 247.8 mm during 2015 and 105.8 mm during 2016 with a rainy days of 11 during 2015 and 7 days during 2016. Higher amount of rainfall was received during May month *i.e.*, 129.4 mm during 2015 and 82.8 mm during 2016. The mean maximum temperatures recorded during crop growth period were highest in April second fortnight (35.5 °C during 2015 and 38.6 °C during 2016) and lowest were in February first fortnight (30.9 °C during 2015 and 32.6 °C during 2016). The average evaporation rate was highest during 2016 (7.65 mm day^{-1}) as compared to 2015 (5.92 mm day^{-1}). Similarly, the average soil temperature was higher in April first fortnight (44.71°C) during 2016 as compared to 42.10 °C during 2015.

The experiment was laid out in split plot design with three replications and comprising twelve treatment combinations with three land configurations as main plot and four irrigation levels as sub plot. Land configurations include, L_1: Broad bed and furrow (BBF), L_2: Corrugated (shallow) furrow and L_3: Ridges and furrow. Whereas, irrigation levels include, I_1: Irrigation once in ten days, I_2: Irrigation at 40 per cent depletion of available soil moisture (DASM), I_3: Irrigation at 50 per cent DASM and I_4: Irrigation at 60 per cent DASM. The net plot area was 3.6 x 4.6 m and the hybrid grown was Pinnacle at the recommended spacing of 60 x 20 cm. Crop was planted on February 6th and harvested on May 31st in 2015 and planted on February 1st and harvested on May 24th in 2016. Broad bed and furrows were prepared with length of 5.4 m, 90 cm width and 12.5 cm deep furrow and each bed occupied two crop rows. With respect to corrugated furrows, shallow depth of 10 cm was maintained. Similarly for ridges and furrows at a depth of 25 cm was maintained. The care was taken to maintain the same number of crop rows (10 rows) and total number of plants in each configuration. The shape of the configurations was maintained through the crop duration. The space of 1 m was maintained between main plots and 0.4 m between sub plots. Similarly separate irrigation channels were prepared in between the main plots as buffer furrow to maintain the treatment effect and to avoid the entry of excess rain or irrigation water in to field. Urea, single super phosphate and muriate of potash were used as sources of NPK at recommended dosages of 150:75:37.5 kg $N:P_2O_5:K_2O$ ha^{-1}. Fifty per cent of nitrogen and 100 per cent phosphorus and potassium were applied as basal dose and remaining 50 per cent of N was applied in two splits at 30 DAS and at tasseling stage. The field was irrigated commonly with sprinkler immediately after sowing for the uniform germination and establishment of crop. Twenty days after sowing irrigation was scheduled according to the per cent depletion of available soil moisture. Prior to each irrigation soil moisture content was measured by using Theta probe.

The quantity of water discharged was measured by Parshall flume (Michael, 2009). The per cent depletion of available soil moisture was calculated by using the following formula and also time required to irrigate each configuration was recorded. The depth of water supplied through irrigation and rainfall was accounted to total depth of water applied treatment wise.

Per cent depletion of ASM =

$$\frac{\text{FC-PWP) x \% depletion}}{100} + \text{PWP}$$

Where, FC- field capacity, PWP- permanent wilting point, ASM- available soil moisture.

Results and Discussion

The two years (pooled) data revealed that growth and yield parameters of maize differed significantly due to land configurations, irrigation levels and their interaction effects.

Growth parameters

Among planting methods, significantly higher plant height was recorded with ridges and furrow method (154.2 cm) and was superior as compared to corrugated furrow (152.6 cm) and broad BBF method of planting, which recorded lowest plant height (150.1 cm) at harvest (Table 1). Better availability of soil moisture and proper root aeration with ridges and furrow method might have favoured cell elongation and division leading to higher plant height of maize as compared to BBF, where partial root stress led to shorter plants. These results are in conformity with the findings of Kang *et al.*, (2000) and Fusheng *et al.*, (2007). Similarly, irrigation at 50 per cent depletion of available soil moisture (DASM) recorded significantly higher plant height (154.7 cm) and was on par with irrigation at 40 per cent DASM (154.0 cm) and both were superior over irrigation once in ten days (150.7 cm) and irrigation at 60 per cent DASM (149.9 cm).

Higher plant height with irrigation at 50 and 40 per cent DASM might be associated with stimulated vegetative growth due to favoured soil moisture regimes. Whereas, in irrigation at 60 per cent DASM moisture stress might promote lignin synthesis, leading to increased stiffness of cell wall and reduction in cell elongation which resulted in reduced plant height. Similar results were reported by Girijesh *et al.*, (2011) and Silungwe *et al.*, (2010). The interaction effect due to ridges and furrow method of planting with irrigation at 50 (156.4 cm) and 40 per cent DASM (155.4 cm) recorded significantly higher plant height and were on par with corrugated furrow at 50 (154.7 cm) and 40 per cent DASM (154.3 cm) as compared to other treatment combinations. However, BBF method in combination with irrigation at 60 per cent DASM recorded significantly lowest plant height (147.5 cm).

The leaf area recorded was significantly higher with ridges and furrow method of planting (3836 cm^2 $plant^{-1}$) and was remained on par with corrugated furrow method (3733 cm^2 $plant^{-1}$) as compared to BBF method (3476 cm^2 $plant^{-1}$) at 90 DAS (Table 2). Taller plants in ridges and furrow might have favoured photosynthesis and assimilation of photosynthates hence higher leaf area was recorded as compared to BBF (Patil and Sheelavantar 2001 and Tumbare and Bhoite 2000). Similarly, irrigation at 40 per cent DASM recorded significantly higher leaf area (3774 cm^2 $plant^{-1}$) and was on par with irrigation at 50 per cent DASM (3730 cm^2 $plant^{-1}$) as compared to irrigation once in ten days (3638 cm^2 $plant^{-1}$) and irrigation at 60 per cent DASM (3584 cm^2 $plant^{-1}$).

Taller plants with irrigation at 40 per cent DASM might be due to better photosynthesis which produced higher leaf area as compared to irrigation at 60 per cent DASM (Abdullah *et al.,* 2015 and Yazar *et al.,* 2009). Significantly higher leaf area was recorded with ridges and furrow method with irrigation at 40 per cent DASM (3876 cm^2 $plant^{-1}$). However, this treatment found statistically on par with ridges and furrow method with irrigation at 50 per cent DASM (3810 cm^2 $plant^{-1}$), corrugated furrow with irrigation at 50 per cent DASM (3808 cm^2 $plant^{-1}$), whereas, significantly lowest leaf area was produced with BBF method at 60 per cent DASM (3238 cm^2 $plant^{-1}$).

Significantly higher canopy temperature was observed with BBF method of planting (34.7°C) and was statistically superior over corrugated furrow method (33.8°C) and ridges and furrow method of planting (33.2°C) at harvest (Table 3). Better moisture availability promoted plant growth and created favourable microclimate that resulted in lower canopy temperature in ridges and furrow as compared to BBF method of planting.

In general, canopy temperature followed the increasing trend with increased soil moisture stress. At harvest, irrigation at 60 per cent DASM observed significantly higher canopy temperature (35.4°C), whereas, irrigation at 40 per cent DASM recorded significantly lower canopy temperature (33.0°C).

Frequent irrigation at lower moisture depletion might result in better crop growth and lower canopy temperature in ridges and furrow over BBF method. The interaction effect of canopy temperature was significantly higher with BBF method of planting at 60 per cent DASM (36.1°C) which was at par with corrugated furrow method at 60 per cent DASM (35.5°C).

Whereas, ridges and furrow method of planting at 40 per cent DASM (32.4°C) recorded significantly lower canopy temperature and was on par with corrugated method at 40 per cent DASM (32.7°C) as compared to rest of treatment combinations.

Yield attributes

Ridges and furrow method of planting recorded significantly higher cob weight (185.4 g) as compared to corrugated furrow (178.9 g) and BBF method of planting (163.4 g). Higher cob weight in ridges and furrow might be associated with taller plants with higher photosynthesis, translocation and accumulation of photosynthates as compared to other methods (Table 4).

Table.1 Plant height (cm) of maize as influenced by land configuration and irrigation levels at harvest

I/L	2015				2016				Pooled			
	L_1	L_2	L_3	**Mean**	L_1	L_2	L_3	**Mean**	L_1	L_2	L_3	**Mean**
I_1	156.6^{ef}	159.3^{c-f}	162.2^{bc}	**159.4^{c}**	139.1^{c}	143.2^{ab}	143.7^{ab}	**142.0^{b}**	147.9^{f}	151.2^{de}	152.9^{b-d}	**150.7^{b}**
I_2	159.7^{c-e}	162.7^{bc}	164.4^{ab}	**162.3^{b}**	144.7^{ab}	145.9^{a}	146.5^{a}	**145.7^{a}**	152.2^{cd}	154.3^{a-c}	155.4^{a}	**154.0^{ab}**
I_3	161.5^{b-d}	164.3^{ab}	167.2^{a}	**164.4^{a}**	144.6^{ab}	145.1^{ab}	145.5^{ab}	**145.1^{a}**	153.0^{b-d}	154.7^{ab}	156.4^{a}	**154.7^{a}**
I_4	155.7^{f}	158.0d-f	160.6^{b-d}	**158.1^{c}**	139.3^{c}	142.2^{bc}	143.9^{ab}	**141.8^{b}**	147.5^{f}	150.1^{e}	152.3^{cd}	**149.9^{b}**
Mean	**158.4^{b}**	**161.1a^{b}**	**163.6^{a}**		**141.9^{b}**	**144.1^{ab}**	**144.9^{a}**		**150.1^{c}**	**152.6^{b}**	**154.2^{a}**	
SV	**S. Em ±**				**S. Em ±**				**S. Em ±**			
L	**0.76**				**0.62**				**0.37**			
I	**0.67**				**0.58**				**0.39**			
L x I	**1.16**				**1.00**				**0.67**			

Table.2 Leaf area (cm^2 $plant^{-1}$) of maize as influenced by land configuration and irrigation levels at 90 DAS

I/L	2015				2016				Pooled			
	L_1	L_2	L_3	**Mean**	L_1	L_2	L_3	**Mean**	L_1	L_2	L_3	**Mean**
I_1	3484^{c}	3632^{bc}	3768^{ab}	**3628^{ab}**	3412^{bc}	3692^{ab}	3840^{a}	**3648^{bc}**	3448^{c}	3662^{a-c}	3804^{ab}	**3638^{bc}**
I_2	3628^{bc}	3748^{ab}	3808^{ab}	**3728^{a}**	3664^{ab}	3852^{a}	3944^{a}	**3820^{a}**	3646^{bc}	3800^{ab}	3876^{a}	**3774^{a}**
I_3	3456^{c}	3756^{ab}	3816^{ab}	**3676^{ab}**	3688^{ab}	3860^{a}	3804^{a}	**3784^{ab}**	3572^{c}	3808^{ab}	3810^{ab}	**3730^{ab}**
I_4	3136^{d}	3660^{bc}	3952^{a}	**3583^{b}**	3340^{c}	3664^{ab}	3752^{a}	**3585^{c}**	3238^{d}	3662^{a-c}	3852^{ab}	**3584^{c}**
Mean	**3426^{b}**	**3699^{a}**	**3836^{a}**		**3526^{b}**	**3767^{a}**	**3835^{a}**		**3476^{b}**	**3733^{a}**	**3836^{a}**	
SV	**S. Em ±**				**S. Em ±**				**S. Em ±**			
L	**19.93**				**34.92**				**26.22**			
I	**43.63**				**52.22**				**38.08**			
L x I	**75.57**				**90.45**				**65.95**			

Land configuration (L)

L_1: Broad bed and furrow
L_2: Corrugated furrow (shallow)
L_3: Ridges and furrow

Per cent depletion of available soil moisture (I)

I_1: Irrigation once in 10 days
I_2: Irrigation at 40 % depletion
I_3: Irrigation at 50 % depletion
I_4: Irrigation at 60 % depletion

Table.3 Canopy temperature (°C) of maize as influenced by land configuration and irrigation levels at harvest

I/L	2015				2016				Pooled			
	L_1	L_2	L_3	Mean	L_1	L_2	L_3	Mean	L_1	L_2	L_3	Mean
I_1	33.1^{b}	31.9^{d}	31.2^{ef}	**32.1^{b}**	37.3^{ab}	36.0^{cd}	34.9^{de}	**36.0^{b}**	35.2^{bc}	33.9^{de}	33.0^{fg}	**34.1^{b}**
I_2	31.8^{d}	30.6^{gh}	30.3^{h}	**30.9^{c}**	36.0^{cd}	34.7^{de}	34.5^{e}	**35.1^{c}**	33.9^{de}	32.7^{g}	32.4^{g}	**33.0^{c}**
I_3	31.6^{de}	31.1^{fg}	30.7^{gh}	**31.1^{c}**	35.8^{cd}	35.1^{c-e}	34.7^{de}	**35.2^{c}**	33.7^{ef}	33.1^{fg}	32.7^{g}	**33.2^{c}**
I_4	34.0^{a}	33.6^{b}	32.6^{c}	**33.4^{a}**	38.2^{a}	37.5^{ab}	36.5b^{c}	**37.4^{a}**	36.1^{a}	35.5^{ab}	34.5^{cd}	**35.4^{a}**
Mean	**32.6^{a}**	**31.8^{b}**	**31.2^{c}**		**36.8^{a}**	**35.8^{b}**	**35.1^{c}**		**34.7^{a}**	**33.8^{b}**	**33.2^{c}**	
SV	**S. Em ±**				**S. Em ±**				**S. Em ±**			
L	**0.10**				**0.17**				**0.13**			
I	**0.09**				**0.23**				**0.14**			
L x I	**0.16**				**0.40**				**0.24**			

*Temperature of outside air was 38.3°C (2016) at harvest

Table.4 Cob weight (g) of maize as influenced by land configuration and irrigation levels

I/L	2015				2016				Pooled			
	L_1	L_2	L_3	Mean	L_1	L_2	L_3	Mean	L_1	L_2	L_3	Mean
I_1	172.7^{cd}	179.3^{ab}	185.6^{ab}	**179.2^{a}**	167.6^{cd}	174.3^{b-d}	181.2^{ab}	**174.4^{a}**	170.1^{ef}	176.8^{cd}	183.4^{b}	**176.8^{b}**
I_2	176.5^{b-d}	186.2^{ab}	190.9^{a}	**184.5^{a}**	171.4^{b-d}	181.4^{ab}	186.5^{a}	**179.7^{a}**	173.9^{de}	183.8^{b}	188.7^{a}	**182.1^{a}**
I_3	169.5^{d}	183.7^{ab}	191.9^{a}	**181.7^{a}**	164.4^{d}	179.3^{ab}	187.5^{a}	**177.1^{a}**	167.0^{f}	181.5^{bc}	189.7^{a}	**179.4^{ab}**
I_4	145.3^{e}	175.6^{b-d}	182.$^{1a-c}$	**167.7^{b}**	140.2^{e}	171.2^{b-d}	177.7^{a-c}	**163.0^{b}**	142.7^{g}	173.4^{de}	179.9^{bc}	**165.4^{c}**
Mean	**166.0^{b}**	**181.2^{a}**	**187.6^{a}**		**160.9^{b}**	**176.5^{a}**	**183.2^{a}**		**163.4^{c}**	**178.9^{b}**	**185.4^{a}**	
SV	**S. Em ±**				**S. Em ±**				**S. Em ±**			
L	**1.91**				**1.88**				**0.91**			
I	**1.83**				**1.81**				**0.93**			
L x I	**3.18**				**3.14**				**1.61**			

Main plot: Land configuration (L)

L_1: Broad bed and furrow
L_2: Corrugated furrow (shallow)
L_3: Ridge and furrow
SV: Source of variation

Sub Plot: Per cent depletion of available soil moisture (I)

I_1: Irrigation once in 10 days
I_2: Irrigation at 40 % depletion
I_3: Irrigation at 50 % depletion
I_4: Irrigation at 60 % depletion

Table.5 Grain yield (q ha-1) of maize as influenced by land configuration and irrigation levels

I/L	2015				2016				Pooled			
	L_1	L_2	L_3	Mean	L_1	L_2	L_3	Mean	L_1	L_2	L_3	Mean
I_1	64.6^{bc}	69.2^{ab}	70.9^{ab}	**68.2^{ab}**	57.3^{cd}	62.2^{bc}	67.6^{ab}	**62.4^{b}**	60.9^{ef}	65.7^{b-e}	69.3^{a-d}	**65.3^{ab}**
I_2	67.6^{b}	73.2^{ab}	73.9^{ab}	**71.6^{a}**	62.2^{bc}	69.0^{a}	71.7^{a}	**67.6^{a}**	64.9^{b-e}	71.1^{a-c}	72.8^{ab}	**69.6^{a}**
I_3	65.4^{bc}	78.3^{a}	72.6^{ab}	**72.1^{a}**	59.2^{cd}	71.6^{a}	71.0^{a}	**67.3^{a}**	62.3^{d-f}	74.9^{a}	71.8^{a-c}	**69.7^{a}**
I_4	57.3^{c}	66.6^{bc}	69.6^{ab}	**64.5^{b}**	53.3^{d}	61.3^{bc}	67.6^{ab}	**60.8^{b}**	55.3^{f}	64.0^{c-e}	68.6^{a-e}	**62.6^{b}**
Mean	**63.7^{b}**	**71.8^{a}**	**71.7^{a}**		**58.0^{b}**	**66.0^{a}**	**69.5^{a}**		**60.9^{b}**	**68.9^{a}**	**70.6^{a}**	
SV	**S. Em ±**				**S. Em ±**				**S. Em ±**			
L	**1.80**				**1.57**				**1.63**			
I	**1.74**				**1.21**				**1.42**			
L x I	**3.01**				**2.10**				**2.46**			

Table.6 Harvest index (%) of maize as influenced by land configuration and irrigation levels

I/L	2015				2016				Pooled			
	L_1	L_2	L_3	Mean	L_1	L_2	L_3	Mean	L_1	L_2	L_3	Mean
I_1	44.0^{ab}	46.2^{a}	45.8^{a}	**45.3^{a}**	43.0^{ab}	42.7^{ab}	45.4^{a}	**43.7^{a}**	43.5^{ab}	44.5^{a}	45.6^{a}	**44.6^{a}**
I_2	44.9^{ab}	46.8^{a}	45.1^{ab}	**45.6^{a}**	44.3^{a}	45.7^{a}	44.0^{a}	**44.7^{a}**	44.6^{a}	46.3^{a}	44.6^{a}	**45.2^{a}**
I_3	44.0^{ab}	47.4^{a}	43.7^{ab}	**45.0^{a}**	42.0^{ab}	46.4^{a}	43.1^{ab}	**43.8^{a}**	43.0^{ab}	46.9^{a}	43.4^{ab}	**44.5^{a}**
I_4	40.3^{b}	45.6^{a}	45.7^{a}	**43.9^{a}**	38.2^{b}	43.1^{ab}	44.9^{a}	**42.0^{a}**	39.2^{b}	44.3^{a}	45.3^{a}	**43.0^{a}**
Mean	**43.3^{a}**	**46.5^{a}**	**45.1^{a}**		**41.8^{a}**	**44.5^{a}**	**44.3^{a}**		**42.6^{a}**	**45.5^{a}**	**44.7^{a}**	
SV	**S. Em ±**				**S. Em ±**				**S. Em ±**			
L	**1.09**				**1.21**				**1.01**			
I	**0.87**				**0.93**				**0.81**			
L x I	**1.51**				**1.61**				**1.40**			

Main plot: Land configuration (L)
L_1: Broad bed and furrow
L_2: Corrugated furrow (shallow)
L_3: Ridge and furrow
SV: Source of variation

Sub Plot: Per cent depletion of available soil moisture (I)
I_1: Irrigation once in 10 days
I_2: Irrigation at 40 % depletion
I_3: Irrigation at 50 % depletion
I_4: Irrigation at 60 % depletion

Tumbatre and Bhoite (2000) recorded significantly higher yield parameters with ridges and furrow method. Similarly, irrigation at 40 per cent DASM produced significantly higher cob weight (182.1 g) and was on par with irrigation at 50 per cent DASM (179.4 g), whereas, statistically lowest cob weight was noticed with irrigation at 60 per cent DASM (165.4 g). Higher cob weight with irrigation at 40 per cent DASM might be associated with higher plant height and leaf area led to better source to sink relationship as compared to higher moisture depletion. Ahmed *et al.*, (2015) recorded higher yield parameters of maize with irrigation at shorter irrigation interval. The interaction effect of ridges and furrow method at 50 (189.7 g) and 40 per cent DASM (188.7 g) recorded significantly higher and on par cob weight over the other treatments. However, the next best treatment in order was corrugated furrow method at 40 per cent DASM (183.8 g), whereas, significantly lowest cob weight was recorded with BBF method at 60 per cent DASM (142.7 g).

The grain yield of maize was significantly influenced by different land configurations, irrigation levels and interaction effect (Table 5). Ridges and furrow method (70.6 q ha^{-1}) and corrugated furrow method (68.9 q ha^{-1}) found on par with each other but produced significantly higher grain yield as compared to BBF method of planting (60.9 q ha^{-1}). The higher grain yield with ridges and furrow and corrugated furrow method might be due to improved growth parameters led to better dry matter accumulation, nutrient uptake and yield attributes. These results are in conformity with the findings of Thumbare and Bhoite (2000). Irrigation at 50 (69.7 q ha^{-1}) and 40 per cent DASM (69.6 q ha^{-1}) recorded significantly higher and on par grain yield with irrigation once in ten days (65.3 q ha^{-1}), whereas, irrigation at 60 per cent DASM recorded significantly lowest grain yield (62.6 q ha^{-1}). Higher grain yield with higher available soil moisture was attributed to higher photosynthesis and translocation of assimilates towards sink led to improved cob weight (Ahmed *et al.*, 2015 and Yazar *et al.*, 2009). The interaction effect was significantly with respect to grain yield of maize. Corrugated furrow with irrigation at 50 DASM recorded significantly higher grain yield (74.9 q ha^{-1}) as compared to other treatment combinations. However, this treatment remained on par with ridges and furrow at 40 (72.8 q ha^{-1}) and 50 per cent DASM (71.8 q ha^{-1}), whereas the BBF method of planting at 60 per cent DASM produced significantly lowest grain yield (55.3 q ha^{-1}).

Harvest index of maize did not respond to land configurations and irrigation levels (Table 6). However, harvest index was ranged from 42.6 to 45.5 per cent between land configurations and from 43.0 to 45.2 per cent among irrigation levels. Among interaction effect of harvest index was significantly with corrugated furrow method at different irrigation levels (44.3 to 46.9 %) and was at par with ridges and furrow method at varied irrigation levels (43.4 to 45.6 %), whereas, BBF method of planting at 60 per cent DASM recorded significantly lowest harvest index (39.2 %). Higher soil moisture availability and aeration throught the crop growth period might have improved the source to sink relationship and produced higher grain yield.

On the basis of results obtained in present investigation, it may be concluded that corrugated furrow method with irrigation at 50 per cent depletion of available soil moisture and ridges and furrow method with irrigation at 40 per cent depletion of available soil moisture significantly enhanced the growth and yield characteristics of maize over the rest of treatment combinations. Broad bed method of planting with irrigation at 60 per cent DASM recorded significantly lowest grain yield of maize.

References

Abdullah, K., Hayrettin Kuşcu, Mehmet, O. and Gamze, B. 2015. The effect of different irrigation water levels on grain yield, yield components and some quality parameters of silage maize (*Zea mays indentata Sturt*.) in Marmara Region of Turkey. *Bot. Horti. Agrobo*, 43(1): 138-145.

Ahmed, A., Alfalahi, H.M., Karem Al-Abodi, Bassam, K., Abdul Jabbar, Amer, M.M. and Khiadher, A.S. 2015. Scheduling irrigation as a water saving practice for corn (*Zea mays* L.) production in Iraq. *Int. J. Appl. Agril. Sci*., 1(3): 55-59.

Anonymous. 2015a. Vision 2050, Indian Institute of Maize Research, Indian Council of Agricultural Research, New Delhi. *www.iimr.res.in.* pp. 1-8.

Deshmukh, S.P., Jayesh, V. and Patel, A.M. 2016. A short review of land configuration to improve the plant growth, development and yield of cereals. *Int. J. Interdisciplinary Res. and Innovations*, 4(3): 1-4.

Fusheng, L., Jihua, L., Shaozhong, K. and Jianhua, Z., 2007, Benefits of alternate partial root-zone irrigation on growth, water and nitrogen use efficiencies modified by fertilization and soil water status in maize. *Pl. and Soil*, 295: 279–291.

Girijesh, G.K., Kumaraswamy, A.S., Dinesh kumar, M., Nataraju, S.P., Vageesh, T.S. and Rajashekarappa, K.S. 2011. Response of maize (*Zea mays* L.) to constraint irrigation under late sown conditions. *Karnataka J. Agric. Sci.*, 24(5): 633-635.

Kang, S., Liang, Z., Pan, Y., Shi, P. and Zhang, J. 2000. Alternate furrow irrigation for maize production in an arid area. *Agril. Water Mgt*., 45: 267-274.

Michael, A.M. 2009. Irrigation Theory and Practice, Vikas Publishing House Pvt., p. 302.

Patil, S.L. and Sheelavantar, M.N. 2001. Effect of *in situ* moisture conservation practices and integrated nutrient management on nutrient availability and grain yield of *rabi* sorghum (*Sorghum bicolor* L.) in the vertisols of semi-arid tropics of south India. *Ind. J. Agric. Sci*., 71(4): 229-223.

Silungwe, F.R., Mahoo, H.F. and Kashaigili, J.J. 2010. Evaluation of water productivity for maize under drip irrigation. *Second Ruforum Biennial Meeting* 20-24 September 2010, Entebbe, Uganda: 725-728.

Tumbare, A.D. and Bhoite, S.U. 2000. Effect of moisture conservation techniques on growth and yield of pearl millet-gram sequence in watershed. *Ind. J. Dry land Agric. Res. and Dev*., 15(2): 94-95.

Yazar, A., Gokcel, F. and Sezen, M.S. 2009. Corn yield response to partial root zone drying and deficit irrigation strategies. *Pl. Soil Environ*., 55(11): 494-503.

How to cite this article:

Hanamant M. Halli and Angadi, S.S. 2017. Response of Land Configuration and Deficit Irrigation on Growth and Yield Attributes of Maize (*Zea mays* L). *Int.J.Curr.Microbiol.App.Sci.* 6(5): 52-60. doi: http://dx.doi.org/10.20546/ijcmas.2017.605.007