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RESPONSE OF IRRIGATED MAIZE (*Zea mays* L) CULTIVARS TO DEFICIT IRRIGATION IN TWO OF THE NIGERIAN SAVANNAS

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Abstract: **Field experiment was carried out during the dry season of 2018 at Federal College of Forestry demonstration farm, Jos, Plateau State, and Irrigation Research Stations of Institute for Agricultural Research (IAR) Kadawa sub-station. The treatments consisted of three maize cultivars (SAMMAZ-18, SAMMAZ-29 and SAMMAZ 40) and three Irrigation Intervals (G = irrigation at all growth, T = except at tasselling and S = except at silking) the treatments were laid out in a split plot design with the variety allocated to the main plot and deficit irrigation to the sub plots and were replicated three times. The result revealed that irrigation at all growth and withdrawing at silking resulted in highest growth, yield attributes and grain yield, a no significant response to deficit irrigation was observed on some yield characters across both locations. It can be recommended that, irrigation at all growth stage or withdrawing irrigation at silking with planting of SAMMAZ – 40 for optimum production of maize under the study areas.**

Keywords: **Deficit Irrigation, Maize cultivars, Two Different Savannas.**

1. INTRODUCTION

Maize (*Zea mays* L.) is an important cereal crop which ranks third after wheat and rice in the world (Onasanya *et al*., 2009). Nigeria is ranked among the 15th most important world producer of maize and the 2nd highest in Africa after South Africa with a total production of about 7.2 million metric tonnes in 2016 (Shiyam *et al*., 2017). The production of this crop has been transformed from that of a minor crop being grown around the homestead to a major or commercial grain crop competing with sorghum and millet as a strategy grain crop in the economy of the nation (Edward *et al.* 2005). The transformation of maize into a cash crop has escalated the demand for the crop. This has created a wide gap between demand and supply arising from the predominantly low maize yield which fluctuates around 1 - 2 tonnes per hectare in traditional farming compared to high yield of about 8.6 tonnes/ha obtained with good crop management (Uguru, 2011).

The production constraints reliance is on natural resources base such as rainfall, insufficient water for irrigation purposes, inadequate infrastructure or lack of good planting materials, limited technological options, and also lack of financial resources are some of the challenges faced by many developing countries (Nigeria inclusive) in maize production, often resulting in low or even declining production levels (WMO, 2012).

The total production of maize is insufficient to meet the ever increasing demand for consumption and other purposes. Although the land for maize cultivation is increasing, the total production is not sufficient to breach the gap between demand and supply. Because of these, an attempt to increase maize production is of great importance. To increase maize production, there are needs for the adequate supply of irrigation water, fertilizers, high yielding cultivars, effective agronomical practices and interventions affecting directly the growth and productivity (Karasu *et al*. 2015) of the crop.

Maize is very sensitive to water stress which can affect its growth, development and physiological processes, reduce biomass and yield. Farré and Faci (2009) noted that, maize needs high amount water during flowering period. Because of this, one of the most important factors that can limit crop production is availability of water. If water stress can be avoided during silking and early ear development, high yield could be expected. Irrigation water supplies are decreasing in many areas of the world, in recent years. Because of the climate change, predictions of increase in temperature and decrease in rainfall, water will become increasingly scarce. Globally, irrigated agriculture is the largest consumer of available fresh water resources, but it is projected that the water that will be available for irrigation will decrease as water is diverted towards non-agriculture sectors. Against these backdrops and in the context of dwindling fresh water reserves, it is imperative that the agricultural sector use its irrigation water more efficiently (Leflaive *et. al.*, 2012). Many farmers in Nigeria are currently facing some irrigation water problems because of shortage irrigation water supplies. This water shortage has motivated some researchers and farmers to find ways to produce maize with less irrigation water and changing from fully-irrigated to deficit irrigated cropping system (Karasu *et al.* 2015). The broad objective of this research work was to investigate the response of maize cultivars to deficit irrigation in two of the Nigerian Savannas.

2. MATERIALS AND METHODS

A. Experimental sites

The experiment were conducted during the dry season of 2018 at two different locations, Federal College of Forestry, Jos located in Jos North local government area of Plateau State which is between latitude of 11^{o}N and longitude 70^{o} and 25^{o} E 1200 m above sea level (Pam, 2009). The second location is Irrigation Research Station Kadawa, *Garun* Malam Local government area, Kano State latitude 11º 11´ N, and long. 7º 36´ E and has considerable seasonal variation in both rainfall and temperature. The soil is alluvial deposits of sandy - loam at the surface (IAR, 1994),

B. Treatments and Experimental Design

The experiment consist of a factorial combination of three maize cultivars (SAMMAZ-18, SAMMAZ-29 and SAMMAZ-40) and three deficit irrigation intervals (AGS= irrigation at all growth Stage, STS= Stopping at Tasselling Stage and SSS= Stopping at Silking Stage) the treatments were laid out in a split plot design with the variety allocated to the main plot and deficit irrigation to the sub plots and were replicated three times. The gross plot size is (12 m^2) consisting of four (4) ridges while the net plot is (3 m^2) consisting of two (2) ridges 0.5 m was left between plots and ally of 1.0 m between replications. The land was ploughed and harrowed twice, levelled and plots and ridges were made as indicated above.

C. Cultural Practices

Seeds were dressed with Apron plus® (Thiametoxam + Metalaxyl-N and Difenoconazole) at the rate of 1 sachet of 10 g per 2 kg seed. Sowing was done by placing two seeds par hole at a spacing of 0.75 m X 0.25 m. Thinning was carried out at 2 WAS leaving one plant par stand. Basal dose of 60 kg ha^{-1} N, P_2O_5 and K_2O in form of NPK (15:15:15) was applied and incorporated into the soil during layout. The remaining split dose of 60kg N ha^{-1} in form of urea (46%) was applied at 4 and 5 WAS by side placement. Application of irrigation water was done as per indicated in the treatment were scheduled at 100, 75, and 50 % of evapotranspiration rate (ET_c) that is irrigation at all growth stage, stoppage at tasselling stage, stoppage at silking stage) respectively.

Weeds were control using Atrazine at 2.0 kg a.i./ha as per emergence a day after sowing and hoe weeding was carried out at 3 and 6 WAS using hoe. The crop in each net plot was harvested manually by removing the cobs after they developed black lines at the base or attachment to the stalk and also as cobs, silk and leaf sheath turned brown in colour and allowed to sundry. Thereafter, the seeds were removed using small hand thresher, the seeds were then separated from the chaff by winnowing, cleaned and weighed. Data were collected on Plant Height, Leaf Area Index (LAI), Crop Dry Matter, Net Assimilation Rate (NAR), Relative Growth Rate (RGR), Water Use and Water Use Efficiency (WUE), Number of Cob per Plant, Weight of Cob per Plant (g), 100 Seed Weight (g), and Grain Yield.

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3. RESULTS AND DISCUSSION

The results of the soil analysis at the experimental sites during 2018 dry season are presented in Table 1. The results showed that, soil textural class for the experimental sites was sandy loam across both locations. The soil had a slightly acidic pH for Jos with 6.08 and 5.60 for Kadawa which is moderately acidic; organic carbon content observed at Jos and Kadawa was 1.61 and 1.15 g kg $^{-1}$. The result showed that, total nitrogen content of 0.47 was observed at Jos and 0.33 g kg^{-1} for Kadawa. The available phosphorus content was 8.5 and 13.04 mg kg^{-1} for Jos and Kadawa respectively. The proportions of the exchangeable cations revealed at lot of variations across both experimental sites while the CEC of the soil analysis was between 7.98 cmol^{+} kgha^{-1} and 8.56 cmol^{+} kg ha^{-1} for Jos and Kadawa respectively (Table 1).

The effect of deficit irrigation and variety on plant height of maize at both locations in 2018 dry season is presented in Table 2. The result showed that, deficit irrigation was significantly different across both locations. Application of irrigation at all growth stage across all locations and sampling periods resulted in taller plants that statistically similar when irrigated up to silking stage during 6 and 10 WAS at Kadawa and Jos respectively as compared with the other deficit irrigations across all sampling periods. This result is in consonance to the finding of Yang (2012) who opined that, water stress significantly reduced height and leaf area of maize and further pointed out that, water stress has an effect on maize and the visible symptoms is reduction in growth, delayed maturity and reduced biomass and grain yield. Stopping irrigation at tasselling and silking resulted in statistically similar and shorter plants across most sampling periods. Similar results have been reported by Hassan, *et al*, (2013). Who reported that, the first sign of water shortage is the decrease in turgor which causes a decrease in both cell development and growth as is an important process that is affected by water stress, especially in the stem and leaves which leads to decrease in plant height which also affect grain yield. In another development Atikullah, *et al.* (2014) reported that plant height increased with increasing number of irrigations on wheat.

Varietal differences significantly influenced plant height at Jos at all sampling periods and at 10 WAS sampling period at Kadawa with SAMMAZ 40 statistically resulting in taller plants as compared with the other two varieties, a non significant differences in plant height was observed in Kadawa at 4, 6, and 8 WAS. Similar findings were reported by Sani *et al*. (2015) that, varieties of maize differ in their potential productivity. Taller plants with higher LAI and good aspect were observed with SAMMAZ 40 giving it an advantage for good crop development that supported the variety to utilize more nutrients.

Table 1: Physical and chemical Properties of Soil at Experimental Sites 2018

Soil Composition	JOS	KADAWA
Physical Composition		
Clay (%)	10.88	13.50
Silt (%)	12.00	16.40
Sand (%)	77.12	70.10
Textural class	Sandy Loam	Sandy Loam
Chemical Composition		
pH	6.08	5.78
Organic carbon (g/kg)	1.61	1.15
Available P (mg/kg)	5.8	6.2
Total nitrogen (N) %	0.047	0.033
Exchangeable cations (cmol^{+} kgha^{-1})		
Calcium	560	532
Magnesium	107	102
Sodium	94.21	92.64
Potassium	90	97.9
Cat ion exchange capacity	7.98	8.56

Source: Soil Science Laboratory, Department Soil Science, Kano University of Science and Technology Wudil.

The effect deficit irrigation and variety on leaf area index (LAI) of maize at Jos and Kadawa in 2018 dry season is presented in Table 2. Deficit irrigation was significantly affected across both seasons and locations. At both locations deficit irrigation was significantly affected at all sampling period except at 4 WAS at Jos where none significant effect was recorded. Across the significant periods and locations, application of irrigation at all growth stage resulted in statistically wider LAI as compared with all other irrigation schedules. Stopping irrigation at silking stage resulted in statistically narrower LAI across all sampling periods and locations that were statistically similar when irrigated was

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stopped at tasselling stage during 6 and 10 WAS at Jos and during 4, 6 and 10 WAS at Kadawa that were not statistically comparable at 8 WAS sampling period across both locations (Table 2). A similar result was observed by Dowsell *et al.* (1996) and Ahmed *et al.*, (2015) that, varieties differ in their adaptation to new ecology, canopy architecture, maturity periods, water use efficiency and yield potential.

Variety significantly influenced LAI across all sampling periods and locations with the SAMMAZ 40 statistically resulting wider LAI as compared with the other two varieties while SAMMAZ 29 and 18 resulted in statistically narrow LAI, however, SAMMAZ 18 recorded statistically the smallest mean values cross all sampling periods and locations indicating the narrowest mean values at 4 WAS at Kadawa (Table 2).

The Interactions of deficit irrigation and variety on plant height was only significant at Jos during 10 WAS with application of irrigation at all growth stage for SAMMAZ 40 recoding statistically the tallest plants as compared with all other possible combination of deficit irrigation and varieties evaluated. Shortest plants were recorded with stopping irrigation at tasselling for both varieties (SAMMAZ 18 and 29) that were statistically similar in most of the possible combinations (Table 3). Edwards *et al.*, (2005) found that, most varieties differences were as a result of genetic makeup and environmental factors.

The Interactions of deficit irrigation and variety on LAI was only significant at Jos during 8 WAS with application of irrigation at all growth stage for SAMMAZ 40 recoding in statistically the wider LAI that was not comparable with all other combinations and closely followed by stopping irrigation at silking stage for the same variety (SAMMAZ 40). Statistically narrower mean values were recorded with stopping irrigation at tasselling and silking for SAMMAZ 18 that were statistically similar with some other possible combinations (Table 3). This is an indication that shortage of water at that time will results in reduction of growth attributes, which in turn resulted in lower photosynthetic activity of the crop Eluzubeir and Mohammed. (2011).

Table 2: Effect of Deficit Irrigation and Variety on Plant Height (cm) and Leaf area Index of Irrigated Maize at Jos and Kadawa, 2018 Dry Season.

Treatment	Plant Height (WAS)								Leaf Area Index (WAS)							
	Jos				Kadawa				Jos				Kadawa			
	4	6	8	10	4	6	8	10	4	6	8	10	4	6	8	10
Deficit Irrigation (DI)																
At all Growth Stage	56.9a	71.9a	102.3a	161.7a	49.7a	71.4a	101.8a	133.4a	0.74	1.13a	1.80a	2.19a	0.82a	1.07a	1.29a	1.65a
Stopping at Tasselling	49.2b	63.6b	87.8b	117.8b	37.4b	51.7b	72.5b	89.2b	0.70	0.95b	1.47b	1.68b	0.63b	0.85b	1.10b	1.33b
Stopping at Silking	46.2b	62.2b	89.4b	151.2a	34.1b	49.4a	64.7b	85.0b	0.65	0.86b	1.23c	1.80b	0.58b	0.80b	1.07c	1.32b
SE ±	1.80	2.08	1.70	7.03	2.26	3.89	4.52	3.41	0.308	0.036	0.079	0.093	0.049	0.032	0.061	0.058
Significance Level	*	*	**	**	**	*	**	**	NS	**	**	*	*	**	*	*
Variety (VRTY)																
SAMMAZ 18	46.4b	57.9b	86.6b	127.3b	38.3	54.7	80.3	89.1b	0.63b	0.86b	1.29b	1.47b	0.53c	0.75b	0.98b	1.22b
SAMMAZ 29	48.7b	61.9b	88.6b	129.2b	39.5	61.0	84.4	91.4b	0.65b	0.87b	1.11b	1.71b	0.60b	0.83b	1.01b	1.30b
SAMMAZ 40	57.1a	77.9a	104.4a	174.3a	43.2	61.0	74.3	107.1a	0.81a	1.22a	2.10a	2.50a	0.89a	1.14a	1.47a	1.78a
SE ±	1.80	2.08	1.70	7.03	2.26	3.89	4.52	3.41	0.308	0.036	0.079	0.093	0.049	0.032	0.061	0.058
Significance Level	*	**	**	**	NS	NS	NS	*	*	**	**	**	**	**	**	**
Interaction																
DI x VRTY	NS	NS	NS	*	NS	NS	NS	NS	NS	NS	*	NS	NS	NS	NS	NS

Means with the same letter(s) in the same column are not significantly different (P < 0.05%) using SNK (students Newman-Keuls test),

Table 3: Interaction between Deficit Irrigation and Variety on Plant Height at 10WAS at and Leaf Area Index at 8 WAS at Jos During 2018 Dry Seasons.

Variety (VRTY)	Deficit Irrigation (DI)		
	AGS	STS	SSS
		Plant Height at 10WAS at Jos	
SAMMAZ 18	125.0bc	114.9c	147.7bc
SAMMAZ 29	142.9bc	109.9c	129.1bc
SAMMAZ 40	217.3a	176.9b	128.6bc
SE ±		12.17	
		Leaf Area Index at 8 WAS at Jos	
SAMMAZ 18	1.32cd	0.94d	1.07d
SAMMAZ 29	1.68bc	1.53cd	1.06cd
SAMMAZ 40	2.56.3a	2.07b	1.26cd
SE ±		1.364	

AGS = At all Growth Stage, STS = Stopping at Tasselling Stage, SSS = Stopping at Silking Stage, Means with the same letter(s) in the same column are not significantly different (P < 0.05%) using SNK (students Newman-Keuls test).

The effect deficit irrigation and variety on net assimilation rate of maize at Jos and Kadawa in 2018 dry season is presented in Table 3. At Jos deficit irrigation was significantly affected at all sampling period except at 4 WAS, while significantly affected across all sampling period at Kadawa. At across all significant periods and locations, net assimilation rate was statistically higher with deficit irrigation at all growth stage, and statistically similar with stopping irrigation at tasselling stage during 4 WAS at Jos. Stopping irrigation at silking resulted in statistically lower net assimilation rate that was statistically similar with stopping irrigation at tasselling across all sampling periods and location except at 4 WAS sampling period.

Variety significantly influenced net assimilation rate (NAR) across all sampling periods and locations. The results indicates that, SAMMAZ 40 significantly recorded the higher net assimilation rate across all sampling periods and locations that was statistically the same with SAMMAZ 20 during 4 WAS at Jos and also statistically similar during 8 WAS at Kadawa (Table 3). In another related development Atikullah *et al.,* (2014) recorded non significant differences between wheat varieties and resulted in lower net assimilation rata across both sampling periods and locations.

The effect of deficit irrigation and varietal differences on water use efficiency of maize at both locations 2018 dry season is presented in Table 3. The result showed that deficit irrigation was significantly affected across the locations. In both locations, application of irrigation at all growth stage significantly produced the more water use efficiency that was statistically similar hen irrigation was exempted at tasselling stage at Jos as compared with the other irrigation schedule across all locations. Stopping irrigation at silking resulted in statistically lower water use efficiency that was similar with exception of irrigation at tasselling across both locations (Table 3). This corroborate with the finding of Eluzubeir and Mohammed. (2011) and Ahmed *et al., (*2015) that, maize or soybean responded to adequate water supply even under dry land intercropping system.

Variety significantly influenced water use efficiency across both locations indicate that, SAMMAZ 40 significantly recorded higher water use efficiency across both locations that was closely followed by SAMMAZ 18 and was statistically similar with SAMMAZ 29 at Jos and not statistically the same at Kadawa (Table 3). The interactions between deficit irrigation and variety on water use efficiency indicate a non significant interaction. Ahmed *et al.,* (2015) find out that, differences between the varieties could also be due to differences in response to soil and water use efficiency which may vary from application time, year to year or from location to location.

The effect of deficit irrigation and varietal differences on cob length of maize at both locations in 2018 dry season is presented in Table 4. The result showed that, it was significant across both locations. Application of irrigation at all growth stage significantly produced in longer cobs than the other irrigation schedules across both locations. However, stopping irrigation at tasselling or silking produced significantly shorter cobs (Table 5).

Variety significantly influenced cob length at Jos only. The response indicates that, SAMMAZ 40 recorded the longest cobs, while shortest cobs were recorded on SAMMAZ 18 that was statistically similar with the SAMMAZ 29 (Table 5). Ertek Kara (2013) showed that, ear length was affected by different irrigation water levels and reported its decrease with decreasing water application.

The effect of deficit irrigation and varietal differences on number of grains per cob at both locations in 2018 dry season is presented in Table 5. The result showed that, deficit irrigation on number of grains was significant at Jos and non significant at Kadawa. Application of irrigation at all growth stage significantly produced more number of grains per cobs that was statistically not comparable with the other irrigation schedules. However, stopping irrigation at tasselling or silking produced significantly less number of grains. This result coincide with finding of Sadalla *et al.* (2013) who pointed out that, significant differences among irrigation treatments for kernel/ear , ear length, grain yield/plant and also Hamidreza *et al.,* (2011) pointed out that, irrigation water has higher productivity in improving yield of maize. Variety significantly influenced number of grains per cob in both locations. The response indicates that, SAMMAZ 40 recorded more number of grains per cobs across both locations

Table 4: Effect of Deficit Irrigation and Varieties on Net Assimilation Rate and Water use Efficiency of Irrigated Maize at Jos and Kadawa, 2018 Dry Season.

Treatment	Net Assimilation Rate (WAS)								Water Use Efficiency	
	Jos				Kadawa				Jos	Kadawa
	4	6	8	10	4	6	8	10		
Deficit Irrigation (DI)										
At all Growth Stage	0.86	1.23a	1.52a	1.89a	0.21a	0.39a	0.64a	0.72a	2.87a	2.20a
Stopping at Tasselling	0.73	1.21ab	1.39b	1.62b	0.15b	0.30b	0.48b	0.63b	1.98ab	1.90b
Stopping at Silking	0.69	1.03b	1.33b	1.60b	0.15b	0.29b	0.43b	0.55c	1.29b	1.57b
SE ±	0.056	0.042	0.039	0.053	0.009	0.021	0.034	0.035	0.326	0.131
Significance Level	NS	*	*	*	**	*	*	*	*	*
Variety (VRTY)										
SAMMAZ 18	0.60b	0.90b	1.22b	1.50b	0.15b	0.29b	0.43b	0.54b	1.47b	1.74b
SAMMAZ 29	0.81a	1.02b	1.30b	1.59b	0.16b	0.28b	0.53ab	0.61b	1.31b	1.30c
SAMMAZ 40	0.87a	1.46a	1.70a	2.00a	0.21a	0.41a	0.57a	0.74a	3.36a	2.64a
SE ±	0.056	0.042	0.039	0.053	0.009	0.021	0.034	0.035	0.326	0.131
Significance Level	*	**	**	**	**	**	*	*	**	**
Interaction										
I x VRTY	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 5: Effect of Deficit Irrigation and Varieties on Cob Length, Number of Grains per Cob, 100-seed Weight and Grain Yield of Irrigated Maize at Jos and Kadawa, 2018 Dry Season.

Treatment	Cob Length (cm)		Number of Grains per Cob		100-seed Weight (g)		Grain Yield (t/ha^{-1})	
	Jos	Kadawa	Jos	Kadawa	Jos	Kadawa	Jos	Kadawa
Deficit Irrigation (DI)								
At all Growth Stage	15.80a	15.63a	640.5a	582.0	43.04a	29.00a	2.64a	2.52a
Stopping at Tasselling	14.38b	14.45b	502.2b	533.3	27.40b	23.11b	1.91b	1.73b
Stopping at Silking	14.10b	14.21b	473.5b	487.8	26.36b	22.00b	1.87b	1.60b
SE ±	0.295	0.341	23.9	27.2	1.43	1.118	0.156	0.104
Significance Level	*	*	**	NS	*	**	*	**
Variety (VRTY)								
SAMMAZ 18	14.11b	14.17b	485.3b	464.4b	25.87b	22.33b	1.59b	1.42b
SAMMAZ 29	14.24b	14.52b	534.5ab	505.1b	27.56b	23.33b	1.81b	1.55b
SAMMAZ 40	15.93a	15.61a	596.5a	633.6a	34.38a	28.44a	3.01a	2.88a
SE ±	0.295	0.341	23.9	27.2	1.43	1.118	0.156	0.104
Significance Level	**	*	*	*	*	*	**	**
Interaction								
I x VRTY	*	NS	NS	NS	*	NS	NS	*

Means with the same letter(s) in the same column are not significantly different ($P < 0.05\%$) using SNK (students Newman-Keuls test).

That were statistically similar with the SAMMAZ 29 at Jos, while less number of grains per cobs was recorded in SAMMAZ 18 across all locations. The interaction was not significant across both locations (Table 5).

The effect of deficit irrigation and varietal differences on 100-seed weight at both locations in 2018 dry season is presented in Table 5. The result showed that, deficit irrigation on 100-seed weight was significant at Jos and also highly significant at Kadawa. Application of irrigation at all growth stage resulted in statistically higher 100-seed weight across both locations that were not comparable with all other irrigation schedules. However, stopping irrigation at silking stage resulted in lower mean values that were statistically the same when irrigation was exempted at tasselling stage (Table 4). Nicolas *et al.* (20089) and Sadalla *et al.* (2013) both pointed out that, significant differences among irrigation treatments exist for kernel or grain weight/plant.

Variety significantly influenced 100-seed weight at both locations. The results indicate that SAMMAZ 40 recorded higher 100-seed weight across both locations, while the lesser 100- seed weight were recorded in SAMMAZ 18 variety but was statistically similar with that of SAMMAZ 29 across both locations. The interaction of deficit irrigation and variety on 100-seed weight was significant at Jos and not significant at Kadawa (Table 5).

The effect of deficit irrigation and variety on grain yield of maize at both locations in 2018 dry season is presented in Table 5. The result showed that deficit irrigation on grain yield was significant at Jos and highly significant at Kadawa. Application of irrigation at all growth stage resulted in statistically higher grain yield across both locations that were not comparable with all other irrigation schedules. However, stopping irrigation at silking stage resulted in lower mean values that were statistically the same when irrigation was exempted at tasselling stage (Table 4). Maize grain yield is sensitive to water stress from just before silking through grain filling, with greater degree of sensitivity occurring during the period of kernel number determination Aguilar *et al.*, (2007). In another development Geerts and Rates, (2009) confirmed that deficit irrigation is successful in increasing water productivity for various crops without causing sever yield reduction.

Variety significantly influenced grain yield in both locations. The results indicate that SAMMAZ 40 recorded higher grain yield across both locations, while the lower grain yield were recorded with the SAMMAZ 18 but was statistically similar with the SAMMAZ 29 across all locations. The interaction of deficit irrigation and variety on grain yield was not significant at Jos significant at Kadawa (Table 4). Eluzubeir and Mohammed. (2011). that, decrease in yield components and grain yield is caused by water deficit during the flowering period (tasselling and silking) of maize crop. The variation observed may have been the reason for the differences between the varieties in all the growth and yield characters examined in this study.

4. CONCLUSION

Based on the results obtain application of irrigation water (deficit irrigation) throughout the research period except at silking, with the withdrawn water at silking stage had produced highest growth characters such as plant height, LAI and NAR. This is because of the importance of water in promoting plant growth and enhancing physiological process and hormonal action. These irrigation schedules resulted in production of adequate yield of the crop. Use of SAMMAZ – 40cultivar responded better than SAMMAZ –18 and SAMMAZ –29 can be recommended to the farmers in the study area.

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