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Effect of Irrigation Intervals on Growth And Yield of Onion (Allium Cepa L.) In Bunza, Kebbi State, Nigeria

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Abstract: *Field experiments were conducted at Kebbi Agricultural and Rural Development Fadama Farm Bunza, Kebbi State about 40km from the state capital Birnin Kebbi (Latitude $12^{o}00^{1}$ and longitude $04^{0}00^{1}$E and 177m above sea level) during 2012/2013 and 2013/2014 dry season to study the effect of irrigation interval on the growth and yield of onion (Allium cepa L.). The treatments consisted of four irrigation intervals (3 day, 5 day, 7 day and 9 day). The treatments were laid out in a randomized complete block design replicated three times. The obtained results from these experiments shows that 3 day irrigation interval had significantly the highest number of leaves, crop growth rate, bulb weight, Bulb yield, cured bulb yield and bulb diameter in both seasons. However, an increase in the number of days between irrigation intervals negatively affected growth and yield performance of onion particularly between the interval of 7 day and 9 day irrigation.*
Keywords: *Onion; Irrigation; Yield.*

I. INTRODUCTION

Onion (*Allium cepa*) belongs to the family (Koccher, 1986). It is believed to have originated in central Asia (Fritsch and Friesen, 2002). Others suggested that it was first cultivated in West Pakistan and Iran (Mara, 1995). In Nigeria farmers produced onion in complex mixture of cropping with other vegetables more importantly tomatoes and pepper. Being one of the most promising vegetable crop grown in Nigeria coupled with its commercial values farmers are more often than not engaged in it production during dry season(hamattan period which has cool, dry weather condition) under irrigation when rainy season cultivation is over. This virtually stems the tide of rural urban migration and is both an income generation and source of employment to a large population of otherwise redundant labour force. Onion production in Nigeria resulted in low yield and could be attributed to factors such as moisture stress and inadequate knowledge of irrigation scheduling by farmer for the production of the crop (Miko *et al*., 2000).

Irrigation is a method of supplying water to supplement or replace rainfall for the purpose of providing moisture for plant growth. This vital in put need careful usage and most of the time not available in the desired quantities and period (Hansen *et al*., 1980). According to Chuman and Maurya (1986) onion require adequate moisture from establishment through to maturity for good growth, yield performance and quality. They also added that vegetables including onion did not tolerate the application of excess water and deficiency may cause substantial reduction in yield. Onion has fibrous and shallow rooting system therefore it requires adequate attention with regards to water requirements. Water as a solvent is essential for successful onion production and act as a pre-requisites for germination through to maturity (Harper, 1983), These premises therefore provides the need to determine the most appropriate irrigation interval for onion production in Bunza Kebbi State, Nigeria so that both its growth and yield potentials would be properly exploited.

II. MATERIALS AND METHODS

Field experiments were conducted at Kebbi Agricultural and Rural Development Fadama Farm Bunza, Kebbi State about 40km from the state capital Birnin Kebbi (Latitude $12^{o}00^{1}$ and longitude $04^{0}00^{1}$E and 177m above sea level) during 2012/2013 and 2013/2014 dry season to study the effect of irrigation interval on the growth and yield of onion (Allium cepa L.). The area lies within Sudan Savanna Agro-ecological zone of Nigeria. The site was a Fadama (low lying site) and usually submerged with rain water from August/September to October/November. The area is characterized by long dry season with cool air during harmattan (November to February), hot dry air during hot season from March to May. The meteorological data during the experimental period are rainfall which last for five (5) months (550-650mm per annum), Minimum temperature of about 22^{o}C and maximum temperature of 41^{o}C. Relative humidity ranged from 21-35% in the morning and 36- 42% in the evenings. Soil of the experimental area was sandy loam with mean pH of 6.5(in $CaCl_2$), Organic carbon 4.5-5.0%; and available phosphorous 4.4ppm.

The treatments consisted of four intervals of irrigation (3, 5, 7, and 9days). They were arranged in a randomized complete block design and each replicated three times. The site was ploughed, harrowed, well level and pegged. Blocks were constructed and in each blocks there were 16 plots each measuring 1.5m x 3m ($4.5m^2$

gross plots with 2.7m as the net plot size), and 0.5m bond separating each plot. Blocks were separated using 2.5m. Irrigation channels were constructed to delever water from a tube well to the plots. Transplanting of seven week old seedlings was carried out on most sunken beds. The intra and inter row spacing were 15cm x 20cm with a single seedling per hill. Seedlings irrigated immediately after transplanting in order to reduce transplanting shock for better establishment. Five pre-treatment irrigations were given initially to enable the seedlings to recover and well established. Irrigation treatments were imposed after two weeks of transplanting. NPK (15:15:15) fertilizer was applied at the rate of 80, 50, and 50kg/ha. Nitrogen was split in to two doses of 40kg and applied at transplanting and the other half (40kg) was top dressed in form of urea (45-46%N) at 4 weeks after first dose. All P and K were applied at bed preparation. All fertilizers were incorporated in to the soil in order to minimize losses. To obtained uniform maturity, irrigation was stopped two weeks before harvesting. Bulbs were harvested when the leaves had turned nearly brown and started falling. Data were collected on number of leaves, crop growth rate, bulb weight, Bulb yield, cured bulb yield and bulb diameter in both seasons. Data were anlysed statistically and multiple comparisons of treatment means were carried out where necessary using Least Significant Difference (LSD) according to Gomez and Gomez (1984).

III. RESULTS

The effects of irrigation interval on growth and yield performance of onion are presented in Table 1 to **3.** The result revealed that number of leaves per plant was significantly affected ($P<0.05$) by irrigation interval in 2012/2013 dry season (Table 1), but in 2013/2014 irrigation interval had no significant effect ($P>0.05$) on the number of leaves per plant. 3 day irrigation interval had significantly produced more number of leaves than 5 day and 9 day irrigation interval and was at par with 7 day irrigation interval (Table 1). However, 5, 7 and 9-days irrigation interval produced statistically the same number of leaves per plant.

The influenced of irrigation interval on crop growth rate of onion after transplanting in 2012/2013 and 2013/2014 dry season is presented in Table 1. Irrigation interval had significant effects ($P<0.05$) on onion growth rate only in 2013/2014 season. No significant effect ($P>0.05$) was observed on the growth rate of onion in 2012/2013 season (Table 1). In 2013/2014, 3- day irrigation interval at 6WAT had significantly higher rate of growth than 7 day and 9- day irrigation intervals and was at par with 5 day irrigation interval. 5, 7, and 9- day irrigation intervals had statistically similar rate of growth at 6WAT. At 9WAT, 3-day irrigation interval differed significantly in terms of growth rate than the rest of irrigation intervals (Table 1).

Mean bulb weight was significantly ($P<0.05$) affected by irrigation interval in both seasons (Table 2). 3 day irrigation interval had significantly higher mean bulb weight than 7 and 9 day irrigation intervals in 2013/2014 season and for 2012/2013 only with 9 day irrigation interval (Table 2). All the remaining interval of irrigation was statistically similar in their mean bulb weight in both seasons.

The influenced of irrigation interval on bulb yield (t/ha) of onion in 2012/2013 and 2013 /2014 dry season is presented in Table 2. The result revealed that irrigation interval had significant effect ($P<0.05$) on bulb yield in both seasons. In 2012/2013 season, 9 day irrigation interval had significantly the lowest bulb yield than 3 and 7 day irrigation intervals but statistically at par with 5 day irrigation interval. 3 day irrigation interval produced significantly ($P<0.05$) the highest bulb yield than the rest of the irrigation interval. In 2013/2014 season, irrigation interval of 3, 5, and 7 day had statistically the same bulb yield while 9 day irrigation interval produced significantly the least bulb yield though at par with 7 day irrigation interval.

Bulb diameter (cm) as affected by irrigation interval during 2012/2013 and 2013/2014 dry season is presented in Table 3. Three day irrigation interval had significantly higher bulb diameter than 5 and 9 day irrigation interval and was at par with 7 day irrigation interval in 2012/2013 (Table 3). The rest of the irrigation interval had statistically similar bulb diameter.

In 2013/2014, 3 and 5 day irrigation had the same bulb diameter statistically and differed significantly from 7 day irrigation (Table 3). Irrigation of 5 day and 9 day were statistically the same.

The effect of irrigation interval on cured bulb yield (t/ha) was significant in both seasons (Table 3). Three day irrigation interval had significantly ($P<0.05$) high cured bulb yield compared to 5 and 9 day irrigation intervals though at par with 7 day irrigation interval during 2012/2013 dry season. In 2013/2014 dry season, 3 and 5 day irrigation intervals that are statistically similar had significantly higher cured bulb yield than 7 and 9 day irrigation intervals that were also the same statistically (Table 3).

IV. DISCUSSION

Water as a solvent is essential for successful vegetable production; it is one of the pre-requisites for germination through to maturity (Harper, 1983). Adequate application of water through irrigation has been known to stimulate growth, development and yield of most vegetable crops including onion. In this investigation, number of leaves, crop growth rate, bulb weight, Bulb yield, and cured bulb yield and bulb diameter in both seasons were found to be significantly higher when onion was irrigated after every 3 days. The result indicated that 3 day irrigation interval had a positive effect on onion production in the study area. This

could be owing to soil type on which the crop (onion) was grown. The soil was sandy loam, therefore, loss of water through evaporation from the surface of the soil, which was aided by wind speed and deep percolation would be very high, thus under such condition, unsteady application of water would definitely have negative effect on the performance of onion (Nassar and Willy, 1977). This is highly likely in most vegetables including onion owing to the fact that its feeding roots are shallow and fibrous and are found within the first 25cm of the soil. Three day irrigation interval appears to be the appropriate interval that met the moisture requirement of the onion in the study area. It positive effect could be attributed to availability of moisture at the root zone and this increased photosynthetic ability of the crop making it to synthesize more assimilates (photosynthates) that are transported to growing region. This resulted in increased crop vigor, through increased leaf number and size, there by influencing both growth and yield performance. Selinger and Hubner (1984), Duranti and Barbieri (1986) reported that frequent irrigation increase crop growth rate and yield. Adequate moisture with the soil always contributes in making nutrients already in the soil and those applied readily soluble and easily available for uptake by onion roots and this resulted in bulb size and quality. This was also reported by Bottcher *et al*. (1977), Bottcher *et al*. (1979) and Choi *et al*. (1980) that frequent irrigation is necessary for good growth and yield performance of onion and garlic especially at bulbing.

V. CONCLUSION

Onion as one of the most vegetable crop cultivated in Nigeria, require frequent application of water for good growth and yield performance. Base on the two season trial conducted in the study area, it revealed that 3 day irrigation was the appropriate interval for maximum growth and yield performance of onion in Bunza, Kebbi State, Nigeria.

Table 1: Crop growth rate (g/m^2/3wk and Number of leaves per plant as affected by irrigation interval during 2012/2013 and 2013/2014 dry season at Kebbi Agricultural and Rural Development Fadama farm, Bunza

Treatment	2012/2013		2013/2014		2012/2013	2013/2014
	6WAT	9WAT	6WAT	9WAT	No. of leaves/plt	
Irrigation Interval (days)						
3	22.13	47.67	26.49[a]	56.27[a]	8[a]	10
5	21.71	37.27	24.41[ab]	35.21[b]	7[b]	9
7	13.70	35.09	15.07[b]	32.23[b]	8a[b]	9
9	13.79	38.38	15.55[b]	36.67[b]	7[b]	10
SE±	3.518	5.919	3.208	6.122	0.208	0.433
Significance	ns	Ns	**	**	**	ns

Within a treatment group, means in a column followed by same letter(s) are not significantly different at 5% level of probability using Duncan New Multiple Range Test (DNMRT).

Table 2: Mean bulb weight (g) and bulb yield (t/ha) of onion as affected by irrigation interval during 2012/2013 and 2013/2014 dry season at Kebbi Agricultural and Rural Development Fadama farm, Bunza.

Treatment	2012/2013	2012/2014	2013/2013	2013/2014
	Bulb weight		**Bulb yield**	
Irrigation Interval (days)				
3	80.00a	81.67[a]	24.54[a]	22.39[a]
5	63.30[ab]	63.33[ab]	18.72[bc]	21.39[a]
7	77.50[ab]	52.50[b]	19.08[b]	18.27[ab]
9	50.83[b]	61.67[b]	15.66[c]	14.98[b]
SE±	9.206	6.279	1.095	1.319
Significance	**	**	**	**

Within a treatment group, means in a column followed by same letter(s) are not significantly different at 5% level of probability using Duncan New Multiple Range Test (DNMRT).

Table 3: Cured bulb yield (t/ha) and bulb diameter (cm) of onion as affected by irrigation interval during 2012/2013 and 2013/2014 dry season at Kebbi Agricultural and Rural Development Fadama farm, Bunza.

	Cured bulb yield (t/ha)		Bulb diameter (cm)	
Treatment	2012/2013	2013/2014	2012/2013	2013/2014
Irrigation Interval (days)				
3	16.59[a]	18.77[a]	6.53[a]	5.48[a]
5	12.76[b]	17.96[a]	5.48[b]	5.12[ab]
7	14.62[ab]	13.98[b]	5.86[ab]	4.58[c]

9	12.58[b]	11.62[b]	4.93[b]	4.71[bc]
SE+	1.038	1.113	0.313	0.144
Significance	**	**	**	**

Within a treatment group, means in a column followed by same letter(s) are not significantly different at 5% level of probability using Duncan New Multiple Range Test (DNMRT).

REFERENCES

[1]. Bottcher, H. Dreibrodt, L and E. Hohne (1977). Effect of airrigation and Manuring on Crop Quality and Storage of Onion. Gartember 1977 24(2) 44-46 (Irrigation and Drainage Abst. 1978. Vol. 4 (2): 572-261).

[2]. Bottcher, H. Frohlich, H. and C. Hubner (1979). Results Regarding the Complex Influence of Sprinkler Irrigation, Plant Diversity and Fertilizer Application on yield Quality and Storability of Onions (Allium cepa L.) Gaten beu (1979) 27 (8) 427-440 (cf: Irrigation and Drainage Abst. 1979. Vol. (2): 754-92.

[3]. Choi, J.K. Ban, C.D. and Y. S. Kwon (1980). Effects of the Amount and Times of Irrigation on Bulbing and Growth in Garlic. Research Reports on the Effect of Rural Development, Horticulture and Sericulture Swun, 1980, 22, 20-33 (cf Hort. Abst. 1981. Vol. 51 (9) Abst 6911 pp 607.

[4]. Choundry, A.B. and E.C. Erinne (1984). Etermination of Optimum Irrigation Frequency for Onion in the Kainji Lake Region of Nigerian Savana. Gartenbau (1984) 49(3) 117-121 {cf: Irrigation and Drainage Abst. 1984. Vol. 10 (1) Abst. 2024pp 226.

[5]. Chuman, B.S. and Mmaurya, P.R. (1986). Response of Onion to irrigation in a Tropical Soil. Agronomy Journal 78(5). 747-757

[6]. Chung, B. (1989). Irrigation and Onion Bulb Quality. Acta Horticulture (1989) 247, 233-237 {Hort. Abst. 1990. Vol. 60 (7) Abst. 5121. Pp591}.

[7]. Duranti, A. and G. Barbieri, G. (1986). The respose of garlic (Allium sativum L.) for storage variation in irrigation regime and in planting density. Rivistu della ortoflorotticoltura Italiana (1986) 70(4) 285-398 {cf: Irrigation and Drainage Abst. 1339 pp 159}.

[8]. Fritisch, R. M., Friesen (2004). Evaluation, Domestication and Texonomy, Allium Crop Science; Recent Advance, Willing ford UK CAB, 92: 29-296.

[9]. Gomez, K.A. and A.A. Gomez (1984). Statistical Procedure for Agricultural Reseach. 2nd Edition. John Wiley and Sons.

[10]. Harper, F. (1983). Principle of Arable Crop Production. Publishers, Black Well, Science Ltd (1999) pp 46-54

[11]. Kochar, S.L. (1986). Tropical Crops, A Textbook of Economic Botany. Macmillan Publishers Ltd. Pp 237.

[12]. Miko, S., M.K. Ahmed, E.B. Amans, A.M. Falaki and N. Ilyas (2000). Effect of Level Nitrogen, Phosphorous and Irrigation Interval on the performance and Quality of Garlic(Allium sativum L.). Journal of Agriculture and Environment. Vol (1) No. 2. Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto.

[13]. Nassar, A. and E.A. Willy (1977). Yield and grade of onion as affected by irrigation frequency and stage of maturity. Annals of agricultural Science 8 129-137

[14]. Singh, T., Singh, S.B., B.N., Kumar, S. and S.S. Singh (1987). Effect of Irrigation and Nitrogen Levels on Yield Attributes of Onion(Allium cepa L.) Under Sodic Soil Condition. Progressive Agriculture 19(3-4) 159-162.