Effects of Nitrogen, Potassium and Weed Interference on Yield of Onion (*Allium cepa L.*) at the Sokoto Rima Valley

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ABSTRACT: Two field trials were conducted during the 2005/2006 and 2006/2007 dry seasons under irrigation at the Usmanu Danfodiyo University Teaching and Research Fadama Farm at Kwalkwalawa, Sokoto (*Latitude* 13^0 1'N and Longitude 5^0 13'E, 350 m above sea level) to study the effects of potassium, nitrogen, and weeding regimes on the bulb yield of onion *(Allium cepa L.)*. The treatments consisted of three levels of potassium (150, 200 and 250 kg/ha), three levels of nitrogen (50, 100 and 150 kg/ha) and three weeding regimes (weedy check, 4 and 6 WAT) laid out in a Randomized Complete Block Design (RCBD) with three replications. Parameters studied included bulb weight (g), bulb diameter (cm) and bulb heights (cm). The result indicated significant ($P<0.05$) effect of potassium, nitrogen and weed interference on the yield of onion. Highest bulb yield was obtained with 250 kg/ha potassium, 150 kg/ha nitrogen and the 4 WAT weeding regime. No bulbs of marketable value were found under the weedy check. Based on the findings of this study, it could be concluded that for optimum bulb yield of onion at Sokoto Rima Vallley, a combination of 250 kg/ha potassium, 150 kg/ha nitrogen coupled with weeding at 4 WAT is the most suitable.
Keywords: Nitrogen, potassium, weed interference, onion, Sokoto, Rima Valley.

INTRODUCTION

Onion (*Allium cepa L.)* is a member of the *Alliaceae* family and one of the most important vegetables in the world, whose utility is ranked second to tomatoes (Brice *et al.*, 1997). Onion can be grown on a wide range of climatic conditions, but thrives best at mild climate without excessive rainfall or extremes of heat and cold (Purseglove, 1972). It requires a land with optimum soil pH of 6.0-7.0 with good tilth and high moisture content (Rahim *et al*., 1992). It is a thermo-and-photosensitive crop (Mondal, 1985). Hence, the production of bulbs in onion is controlled by photoperiod, though temperature has marked influence. The day length requirement for onion varies from 11-16 hours.

Onion is consumed in different ways by different people and forms an essential part of the traditional daily diet. It is a major spice item, and ranks among the top 5 vegetables in Nigeria, (NIHORT, 1986). It can be eaten raw, in salad, fried, boiled or roasted, and also used in flavoruing soups, canned food products and other savoury dishes. It is used in every home virtually on daily basis (Hussaini *et al.*, 2000). The bulb is used traditionally as a medicinal herb for the treatment of measles, pneumonia, cold and catarrh. Recent studies have confirmed that onion helps in fighting *Osteoporosis* or bone loss (Biochemist, 2005). Onion production is a viable industry that employs plenty of labour and the bulbs are traded in large quantities within and between countries of the world (Currah and Proctor, 1990).

Despite the ranking of onion as the second most important vegetable in Nigeria, the present production levels do not meet the demand of the teeming populace. Limited changes in the traditional production practices may still be lagging behind the national demand (Denton and Ojeifo, 1990). Though the consumption of onion cuts across the country, its production is limited to the northern part of the country, where even in the north, production is restricted to *Fadama* areas, and grown mostly during the dry season under irrigation. Similarly, the production level at present is below the optimum realized for other countries, for example, while it is 45 tha^{-1} in India, in Nigeria, it is just 15 tha^{-1} (FAO, 2005).

Several factors are responsible for this discrepancy, ranging from agronomic practices, nursery raising, transplanting, plant population, provision of good quality seeds and seedlings, weeding, irrigation, fertilizer application and the prevalence of pests and diseases. Most farmers do not know the correct dosage of fertilizers, when and how to apply for optimum onion production (Magaji *et al.*, 1994). The density effect, frequency impact, timeliness of weeding and chemical weed control methods, herbicides use and application all pose great limitations to farmers (Yakubu, 2000). Hence, this study was aimed at studying the effects of potassium, nitrogen and weeding regimes on the bulb yield of onion, with a view to fashioning out the ideal combination for optimum onion production in North West Nigeria.

MATERIALS AND METHODS

Field trials were conducted during the 2005/2006 and 2006/2007 dry seasons at the Usmanu Danfodiyo University Teaching and Research *Fadama* Farm, located at Kwalkwalawa, village in Sokoto. Sokoto lies on latitude 13°01'N and longitude 5°15'E and about 350m above sea-level (Kowal and Knabe, 1972). Sokoto falls under the Sudan savanna agro-ecological zone of Nigeria. The climate is characterized by a long dry season with cool dry air during the *Harmattan*, from November to February, and hot season from March to May then followed by a short rainy period from June to September (Davies, 1982). The experimental site lies in the Sokoto Rima valley flood plain *fadama*, which is usually submerged by flood water from August/September–October/November. Average temperature ranges from 18.7 to 39°C during the coldest and hottest periods of the year respectively (SERC, 2006).

The treatments consisted of three levels of potassium (150, 200 and 250 kg/ha), three levels of nitrogen (50, 100 and 150 kg/ha) and three weeding regimes (unweeded, 4 and 6 WAT) laid out in a Randomized Complete Block Design (RCBD) with three replications which gave a total of 81 plots each measuring 3 m^2 with 1m inter-row paths and watering channels. The total land area was 783 m^2. Seeds of "Yar-ankara-Ja" (Ex-Accra Red) were obtained from Institute for Agricultural Research, Ahmadu Bello University, Zaria. Nursery beds of 1.0 x 3.0 m were marked out and cleared, then the seeds drilled into rows 15 cm apart. The research site being a *Fadama* land is marshy and flooded during the rainy season. This was allowed to recede considerably, then a tractor was used for mechanical ploughing and harrowing. The large colloids were broken down in order to make the land into a fine tilth, after which 81 plots of 3 x 3 m each were measured, demarcated and laid out. Irrigation and drainage channels of 1m were also made for conveyance and drainage of excess water.

At seven weeks after sowing, the seedlings were about 15 cm in height, hence ready for transplanting, which was done on the 25th of December, for both seasons. A three – day irrigation interval was maintained for the first four weeks, then extended to a 7 days interval till 14 days to harvest, then irrigation was stopped completely so as to cure the bulbs. First weeding was done at 4 weeks after transplanting (WAT), while the second was at 6 WAT. Potassium at 150, 200 and 250 kg/ha and nitrogen at 50, 100 and 150 kg/ha were split applied at 4 and 6 WAT, respectively.

The parameters measured were bulb weight (g), bulb diameter (cm) and bulb height (cm). The data collected were subjected to analysis of variance using the statistical analysis systems (SAS) package. Treatment means were compared for significant differences using the least significant difference as outlined by Gomez and Gomez (1984).

RESULTS

Table 1 presents the effect of potassium, nitrogen and weed interference on the bulb yield (t/ha) of onion during the 2005/2006, 2006/2007 dry seasons and the combined years in Sokoto.

The fresh bulb weight of onion was significantly ($P<0.05$) affected by the application of varying levels of potassium, nitrogen and weed interference in both seasons and the combined analysis. At harvest, the highest mean fresh bulb weights of 36.90 t/ha were produced with the application of 150 kg/ha nitrogen and 250 kg/ha potassium in 2006.

Table 1: Effect of potassium, nitrogen and weed interference on the fresh bulb weight (g) of onion during 2006 and 2007 dry seasons and the combined years in Sokoto

Treatments	2006	2007	Combined
Potassium			
(kg/ha)	26.91c	25.68c	25.01c
150	31.46b	30.11b	30.28b
200	36.29a	37.08a	37.71a
250	1.080	1.170	1.43
SE±	*	*	*
Significance			
Nitrogen			
(kg/ha)	27.82c	25.44b	26.63c
50	32.52b	27.26b	30.40b
100	36.90a	34.18a	37.03a
150	1.080	1.170	1.160
SE±	*	*	*
Significance			
Weeding			
(WAT)	20.22c	21.77c	20.00c
0	32.09a	38.908a	35.43a
4	28.23b	33.03	32.03b
6	1.080	1.170	1.370
SE±	*	*	*
Significance			
Interaction			
K x N	*	*	*
K x W	Ns	NS	NS
N x W	NS	NS	NS

Means followed by the same letter(s) within treatment group are not significantly different at 5% probability level using Least Significant Different (LSD).
* - Significance at 5% level
WAT - Weeks after transplanting

Potassium application affected the fresh bulb weights of onion significantly ($P<0.05$). There were significant differences between the 3 levels of potassium applied in 2005/2006, 2006/2007 and the combined analysis.

The application of varying levels of nitrogen was also found to affect the fresh bulb weight significantly ($P<0.05$) at harvest in both seasons, and the combined analysis. All the three levels of nitrogen applied produced statistically different mean fresh bulb weights.

Weed interference also affected the fresh bulb weights of onion significantly. Highest weights were obtained under the 4 WAT weeding regime for 2005/2006, 2006/2007 seasons and the combined analysis, while the least fresh bulb weights were found under the weedy check in both seasons and the combined analysis.

Table 2: Fresh bulb weight (gm) as affected by potassium X nitrogen interaction during 2005 2006 by season at sokoto.

	Nitrogen (kg/ha)		
Potassium	50	100	150
150			
200	27.31d	30.11c	30.34c
250	29.20cd	34.31b	37.83a
SE±	28.14cd	38.02a	39.42a
		1.033	

Means followed by the same letter(s) are not significantly different at 5% probability level using DMRT.

Table 3: Interaction of potassium and nitrogen on fresh bulb weight (g) in 2007 at Sokoto

	Nitrogen (kg/ha)		
Potassium	50	100	150
150	27.85d	32.48cd	34.43bc
200	28.21d	33.21cd	39.48ab
250	28.77d	39.69ab	40.49a
SE±		**2.067**	

Means followed by the same letter(s) are not significantly different at 5% probability level using DMRT.

Table 4: Interaction of potassium and nitrogen on fresh bulb weight (g) in the combined analysis a Sokoto

	Nitrogen (kg/ha)		
Potassium	50	100	150
150	18.23f	29.77d	26.43e
200	17.22f	34.43b	31.31cd
250	17.78f	39.52a	33.28b
SE±		**1.020**	

Means followed by the same letter(s) are not significantly different at 5% probability level using DMRT.

DISCUSSION

Highest fresh bulb weights were obtained with the highest dose of potassium applied (250kg/ha) Cooke (1982) had earlier stated that large amounts of potassium are essential for high bulb yields in onion. The significant effect of potassium on onion yield has also been confirmed by FMA (1989). Zink (1966) found out that onion removed potassium slowly during early growth, and increases at the bulbing stage where approximately 47% of total potassium was utilized.

The increased yield in fresh bulb with a corresponding increase in the level of nitrogen applied noticed in the result tallies with the earlier studies of Amans (1992). The result is however, at disparity with Aliyu (2006) who reported a yield of 45.05 t/ha with 150 kg/ha nitrogen. The discrepancy, may, perhaps be due to increased temperature and low relative humidity during the present study NIMET (2008).

Highest bulb yields were obtained from the 4 WAT weeding regime. This confirmed the contention by Raemaekers, (2001) that the critical period of competition in onion is the 4th WAT. The least yields under the weedy check further confirmed the poor competing ability of onion as earlier stated by TDRI (1986), Akobundu (1989) and Raemarkers (2001).

Significant interaction of potassium and nitrogen on one hand, and potassium and weed interference on the other had been reported by Amans (1992) and El-Bassiony (2006).

CONCLUSION

The application of potassium, nitrogen and weed interference had a significant effect on onion bulb under irrigation during the 2005/2006 and 2006/2007 dry seasons at the Sokoto Rima Valley. Our study indicate that a combination of 250 kg/ha potassium, 150 kg/ha nitrogen and 4 WAT weeding regime is best for optimum onion production in the Sokoto Rima Valley.

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