Influence of different grades and rates of organic fertilizer on the growth, yield and quality of onion (*Allium cepa*).

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ABSTRACT

Pot experiment was conducted to assess the influence of fertilizer types and rates on the growth, yield and nutritional quality of onion. The treatments were 0, 30, 60, 90, 120kg ha^{-1} of two fertilizer grades (fortified and unfortified sunshine organic fertilizers).The 5×2 factorial experiment in a randomize complete block were laid out in a randomized complete design replicated three times. Data were collected on growth parameters, yield attributes, nutritional content and proximate analysis of onion. The growth parameters (plant height and number of leaves) and yield (bulb diameter, leaves and bulb weight).The nutritional quality of onion was significantly influenced ($p< 0.05$) by the rate and fertilizer type. The highest plant height and number of leaves were obtained from onion plants treated with fortified organic fertilizer, irrespective of the rates. Although, there was no significant difference between the values obtained from 90 and 120kg ha^{-1}, the highest growth parameters were obtained at 120kg ha^{-1}, irrespective of fertilizer types. The yield parameters and nutritional values of onion increased from 0 up till 90kg /ha, then declined thereafter at higher fertilizers rate. The optimum yield with nutritional quality was obtained from onion treated with unfortified organic fertilizer at the rate of 90kg ha^{-1}. In conclusion, the best fertilizer type and rate under this investigation for maximum yield and nutritional value of onion are unfortified sunshine organic fertilizer applied at 90kg /ha.

Keywords: *Allium cepa, yield, quality, fortified and unfortified organic fertilizer.*

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INTRODUCTION

Onion (*Allium cepa L.*) is a member of the Alliacea family and one of the most important vegetables in the world. It is rich in vitamins and minerals and has several medicinal values. It can be eaten raw, in salad, fried, boiled or roasted, and also used in flavoring soups, canned food products and other savory dishes. Onion is used in every home virtually on daily basis (Hussaini *et al.,* 2000). Growers often face severe problems in the production and marketing of onion and sometimes they do not gain better profits because they spend greater portion of their capital for purchasing fertilizers. Generally, excessive amounts of inorganic fertilizers are applied to onion like other vegetables in order to achieve a higher yield (Steward *et al.,* 2005). Continuous usage of inorganic fertilizer affects soil structure and other physical and chemical properties. Hence, organic manures can serves as an alternative to mineral fertilizers as reported by Naeem *et al.* (2006). Organic farming provides several benefits to the growers. It reduces production cost and environmentally friendly method of cultivation. Addition of organic fertilizers improves soil structure and enhances activities of useful soil organisms. The use of organic manure alone may not give reasonable economic yield, hence it is vital to find appropriate combinations of inorganic and organic manure to obtain financially viable yield of crops. Jeyathilake *et al.* (2006) reported that integrated use of bio-fertilizer, organic manure and chemical fertilizers resulted in onion yield increase when compared with the exclusive application of chemical fertilizers. Therefore, this research work was designed to investigate the effect of organic fertilizer types and rates required for maximum yield and nutritional value of onion.

MATERIALS AND METHODS

Pot experiment was conducted in 2010 at the Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. Ogbomoso is located on longitude $4^{o}\ 10^{/}$ and latitude $8^{o}10^{/}$ in the Guinea Savanna zone of Southwest Nigeria. Soil samples were collected after mixing and sieving of soil obtained from the Gmelina plantation for physico - chemical analysis. The soil samples were air dried and sieved with wire mesh of 0.02 mm sieve. The particle size was determined by using the Bouyocous (1962) hydrometer method. After sterilization of the soil, 27 polyethylene bags were filled up and arranged 1m x 0.5m dimension. These were arranged in three replicates with each replicate containing 9 polybags filled with 5kg soil. Onion red creole variety which is widely cultivated and consumed in different ecological zones in Nigeria was used. The seeds were collected from the Seed

Project Company Limited, Adejia Road, Kano, Nigeria. These were subjected to two fertilizer grades; sunshine fortified (SFF) (3.5%N, 2.5%P and 1.5%K) and unfortified sunshine (SUF) (2.5%N, 1.7%P and 2.0%K) organic fertilizers. Each fertilizer type was applied at 5 different rates (0, 30, 60, 90 and 120kg/ha). Both fertilizers (SFF and SUF) are products of Ondo State Government Organic Fertilizer Factory. The 10 treatments were applied to the onion seedlings at three weeks after sowing. The fertilizer was applied at the base of plants. The fertilizer types were applied to the onion as equivalent nitrogen sources: T2 = 0.15kg N/bed (30kg N/ha), T3 = 0.31kg N/bed (60kg N/ha), T4 = 0.46kg N/bed (90kg N/ha), T5 = 0.62kg N/bed (120kg N/ha) through fortified sunshine fertilizer; T6 = 0.22kg N/bed (30kg N/ha), T7 = 0.43kg N/bed (60kg N/ha), T8 = 0.65kg N/bed (90kg N/ha) and T9 = 0.86kg N/bed (120kg N/ha) through unfortified sunshine fertilizer. Treatments were laid out in a randomized complete design replicated thrice. Three seeds were sowed per polybag at 0.5 cm depth due to the small rounded nature of the seeds. Fertilizer types were applied at sowing by mixing with the soil at their respective rates. Other normal cultural practices used for onion production, such as irrigation to minimize the environmental stress and for better crop establishment, weeding at three weeks intervals, and pest control fortnightly with neem seeds extract at the rate of 20ml/10L of water were used. Growth parameters measured include numbers of leaves and plant height (cm).Data collection commenced at 6WAS and continued fortnightly till harvesting. At harvesting, onion yield attributes such as bulb diameter (cm), bulb yields (g/plant and kg/ha) were calculated and recorded from three plant samples which were taken from each treatment at 3MAS. The chemical constituents as nutritional value (Percent Crude protein, Crude fiber, Moisture content, Fat, Ash, Vitamin C, Phosphorus (P), Potassium (K), Calcium (Ca) and Magnesium (Mg)) of onion leaves and bulbs were determined using the method described by AOAC (1990). All data collected were subjected to ANOVA and significant means were separated by the least significant differences (LSD) at 5% probability level.

RESULTS AND DISCUSSION

Growth parameters

The plant height and number of leaves of onion as affected by organic fertilizer types and rates are presented in tables 1 and 2. The plant height and number of leaves of onion were significantly improved ($P \leq 0.05$) by the fertilizer type and rate effects. Irrespective of fertilizer types, there was no significant difference between the values obtained at 90 and 120kg ha^{-1} of applied fertilizer types, growth parameters increase with increase in fertilizer

application. The application of fortified sunshine organic fertilizer gave the highest plant height and number of leaves of onion as compared with the values obtained from plant that received unfortified sunshine organic fertilizer, irrespective of the rates. The interactive effect of fertilizer type and rate had significant ($P \leq 0.05$) influenced on plant height and number of leaves.

Total onion yield

The total yield (leaves and bulbs) and its components of onion plant are presented in Table 3. The leaves weight (g plant^{-1}), leaves yield (kg ha^{-1}), bulb diameter (cm), bulb weight (g plant^{-1}) and bulb yield (kg ha^{-1}) were significantly influenced ($P \leq 0.05$) by the combined fertilizer type and rate effects. These yield and yield components of onion plant increased as the applied fertilizer rates increases up till 90kg ha^{-1}, thereafter, the yield declines irrespective of fertilizer types. At harvesting, the onion plants nourished with unfortified sunshine organic fertilizer had higher leaves and bulbs yield of onion while those onion plants treated with fortified sunshine organic fertilizer gave the least yield values, irrespective of the fertilizer rates.

Nutritional value of onion

The effect of fertilizer types and different application rates on the nutritional quality of onion bulbs and leaves are shown in table 3 and 4. The percent crude protein, crude fiber, moisture content, fat ash, vitamin C, P, K, Ca and Mg contents of both onion bulbs and leaves were significantly improved ($P \leq 0.05$) by the fertilizer type and rate. The percent crude protein, crude fiber and fat contents of onion bulbs increased with increase in fertilizer rates up till 90kg Nha^{-1}, thereafter, it decreases irrespective of fertilizer types. Although, there are inconsistencies in the percent moisture content, ash and vitamin C contents values of onion bulbs as the fertilizer rates increased, however, the maximum values were obtained from plants under 90kg Nha^{-1} treatment. The percent crude protein, crude fiber, moisture content, fat, ash, vitamin C, P, K, Ca and Mg followed the same trend. Onion plants treated with unfortified sunshine organic fertilizer gave better quality and chemical constituents of onion bulb and leaf more than those plants treated with fortified sunshine organic fertilizer treated plants. Giardini *et al.* (1992) made similar observation and concluded that poultry manure improved the onion quality better than mineral fertilizer. The suitability and usefulness of poultry manure as an organic fertilizer has been attributed to high availability of NPK content it contains (Waddington, 1998). Poultry manure is a good depositor of major and minor mineral elements that are capable of enhancing soil fertility on application (Mc Calla, 1974; Thomas, 1997). It also acts as a substrate for soil micro-organisms and increases microbial

activities, thus decomposing faster and releasing nutrients for plant uptake (Miller, 1974). The crop yield response to organic waste is highly variable and depends on the types of wastes, crop type and species, soil type and climate conditions (Adediran *et al.,* 2003). Akanni and Ojeniyi (2007) carried out a study in the rainforest zone of Southwest Nigeria and recommended 20t ha^{-1} of poultry manure for tomato production. Adediran *et al.,* 2003) also found that poultry manure at 20t ha^{-1} gave the highest tomato yield in the rainforest region of Southwestern Nigeria. Application of unfortified fertilizer at 90kg ha^{-1} gave the best P content of onion bulb (14.60 mg/100g) while onion bulb harvested from plot treated with fortified sunshine fertilizer at the rate of 60kg ha^{-1} produced onion bulb with the highest P content (12.94 mg/100g). The least P content was recorded in control pot. In the same way, the K content in onion bulb with unfortified sunshine fertilizer had higher value compared to fortified sunshine fertilizer. The plots treated with 90kgha^{-1} fortified fertilizer had the highest (55.27 mg/100g) value of k content in the bulb while the lowest value (40.75 mg/100g) was obtained from plant with no fertilizer.

Nutritional content of onion leaf

Fertilizer type at different application rates had influence on the nutritional value of onion leaf ($P \leq 0.05$). The percent crude protein, crude fiber, moisture content, fat, ash, vitamin C, P, K, Ca and Mg contents were significantly improved ($P \leq 0.05$) by fortified and unfortified sunshine fertilizer at different application levels. Onion plant treated with unfortified sunshine fertilizer gave better mineral constitution of onion leaf than fortified sunshine fertilizer treated plant. Application of unfortified fertilizer at 90 kg ha^{-1} gave the best P content of onion leaf (10.60 mg/100g) while onion leaf harvested from pot treated with fortified sunshine fertilizer at the rate of 120kg ha^{-1} produced onion bulb with the highest P content (9.60 mg/100g). Likewise the K content in onion leaf, unfortified sunshine fertilizer had higher value compared to fortified sunshine fertilizer pots that had the rate of 60kg ha^{-1} fortified fertilizer had the highest (11.60 mg/100g). The least was recorded in unfertilized pot. The Ca and Mg content of onion bulb was significantly ($P \leq 0.05$) influenced by fertilizer type and application rate. Unfortified sunshine fertilizer gave better Ca and Mg mean value (9.93 mg/100g and 0.24 mg/100g respectively) compared to fortified fertilizer. Fortified sunshine had highest Mg value at 30kg ha^{-1} and 120kg /ha (0.08 mg/100g) but the highest Ca content was obtained from 60kg ha^{-1} (9.74 mg/100g) of onion leaf. The application of unfortified fertilizer at 90 kg/100g produced the richest onion leaf with Mg content while the control had the least value.

Table 1: Influence of fortified and unfortified sunshine organic fertilizer types and rates on the onion plant height.

Fertilizer rate (kg/ha)	Weeks After Sowing (cm) 6	8	10	12
		Unfortified Organic Fertilizer		
0	17.43	20.00	23.43	25.70
30	18.43	21.50	24.40	26.50
60	18.67	23.07	26.40	26.67
90	23.03	25.67	27.67	30.10
120	23.30	27.07	29.40	31.70
Mean	20.17	23.46	26.26	28.13
		Fortified Organic Fertilizer		
0	16.70	18.80	21.63	24.13
30	19.17	21.50	24.40	26.67
60	19.40	22.43	25.63	27.77
90	20.50	23.47	26.10	26.67
120	26.30	29.33	31.93	34.70
Mean	20.41	23.11	25.94	27.99
LSD (5%)				
F Type	38.72	19.16	36.56	36.25
F Rate	24.77	33.44	23.68	7.63
F Type × F Rate	19.14	19.45	15.09	

Table 2**:** Influence of fortified and unfortified sunshine organic fertilizer types and rates on the number of leaves of onion plant.

Fertilizer rate (kg/ha)	Weeks After Sowing			
	6	8	10	12
		Fortified Organic Fertilizer		
0	5.33	6.00	9.00	10.67
30	6.33	9.30	9.33	10.67
60	6.67	7.33	9.67	11.33
90	7.00	11.00	12.33	13.67
120	9.67	11.67	12.67	14.33
Mean	7.00	9.06	10.6	12.13
		Unfortified Organic Fertilizer		
0	3.33	4.67	6.00	7.00
30	5.67	7.00	8.33	10.00
60	6.00	7.33	9.00	10.67
90	9.00	10.00	11.30	12.00
120	7.00	9.06	10.60	12.13
Mean	7.2	8.80	10.19	10.87
LSD (5%)	12.00	15.00	16.33	16.67
F Type	27.87	32.72	34.43	38.09
F Rate	18.03	21.12	21.91	24.61
F Type × F Rate	13.92	16.32	16.92	18.97

Table 3: Influence of fortified and unfortified sunshine organic fertilizer types and rates on yield attributes of onion.

Fertilizer rate (kg/ha)	Leaf weight (g/plant)	Bulb weight (g/plant)	Bulb diameter (cm)
		Fortified Organic Fertilizer	
0	3.00	17.30	0.10
30	6.00	17.98	0.95
60	6.00	19.77	1.50
90	7.00	29.73	1.50
120	6.50	20.95	1.30
Mean	5.70	21.14	1.27
		Unfortified Organic Fertilizer	
0	4.03	19.77	0.10
30	6.37	23.70	1.10
60	6.63	24.33	1.10
90	15.60	48.46	2.50
120	11.20	30.57	1.15
Mean	8.76	35.48	0.98
LSD (5%)			
F Type	34.32	125.58	16.53
F Rate	22.17	80.93	10.69
F Type× F Rate	17.05	62.39	8.23

Table 4: Influence of fortified and unfortified sunshine organic fertilizer types and rates on the nutritional content of onion bulb.

Fertilizer rate (kg/ha)	%P	%K	%Ca	%Mg
	Fortified Organic Fertilizer			
0	10.50	40.75	35.60	0.21
30	10.60	43.66	43.70	0.36
60	11.94	45.66	48.80	0.38
90	12.60	45.89	39.90	0.40
120	12.10	41.80	42.00	0.36
Mean	11.55	43.55	42.00	0.34
	Unfortified	Organic	Fertilizer	
0	10.50	40.75	35.60	0.21
30	12.85	50.48	42.80	0.45
60	11.72	48.60	44.75	0.48
90	14.60	55.27	48.50	0.51
120	12.61	43.86	44.84	0.38
Mean	12.46	47.79	43.30	0.40
LSD (5%)				
F Type	0.54	4.22	8.39	0.19
F Rate	0.35	2.72	5.43	0.01
F Type × F Rate	0.27	2.06	4.18	0.21

Table 5: Influence of fortified and unfortified sunshine organic fertilizer types and rates on the nutritional content of onion leaf.

Fertilizer rate (kg/ha)	%P	%K	%Ca	%Mg
	Fortified Organic Fertilizer			
0	7.40	11.20	8.74	0.05
30	7.52	10.98	5.60	0.05
60	9.40	11.60	9.74	0.06
90	9.94	13.04	9.74	0.08
120	9.60	12.84	9.54	0.08
Mean	8.77	11.93	8.57	0.07
	Unfortified	Organic	Fertilizer	
0	7.40	11.20	9.24	0.05
30	9.70	13.60	9.60	0.10
60	10.60	15.75	10.80	0.14
90	10.64	18.40	12.40	0.18
120	9.41	13.20	9.60	0.12
Mean	9.35	13.23	9.93	0.24
LSD (5%)				
F Type	3.36	29.96	4.55	0.38
F Rate	1.67	6.44	2.94	0.24
F Type ×F Rate	1.67	4.96	2.26	0.19

Table 6: Influence of fortified and unfortified sunshine organic fertilizer types and rates on nutritional value of onion bulb.

Fertilizer rate (kg/ha)	%Crude protein	%Crude fiber	%Moisture content	%Fat	%Ash	%Vitamin C
			Fortified Organic Fertilizer			
0	2.14	0.10	15.66	0.18	0.60	9.86
30	2.18	1.11	14.24	0.29	0.75	10.78
60	2.25	1.12	14.72	0.30	0.68	8.84
90	2.40	1.18	26.52	0.31	0.84	11.75
120	2.30	1.16	11.35	0.26	0.70	9.04
Mean	2.25	0.93	12.49	0.27	0.71	10.25
		Unfortified	Organic	Fertilizer		
0	2.14	0.10	15.66	0.18	0.60	9.86
30	2.28	1.15	21.60	0.28	0.84	10.07
60	2.31	1.10	15.20	0.31	0.76	10.91
90	3.24	1.5o	34.11	0.34	0.93	12.28
120	2.20	1.15	18.84	0.30	0.82	9.21
Mean	2.43	0.98	21.08	0.28	0.79	10.27
LSD (5%)						
F type	1.95	2.45	4.86	0.68	0.99	4.30
F rate	1.29	0.01	2.78	0.01	0.01	2.89
F type × F rate	1.00	0.04	2.32	0.03	0.52	2.23

Table 7**:** Influence of fortified and unfortified sunshine organic fertilizer types and rates on nutritional value of onion leaves.

Fertilizer rate (kg/ha)	%Crude protein	%Crude fiber	%Moisture content	%Fat	%Ash	%Vitamin C
	Fortified	Organic	Fertilizer			
0	0.30	0.07	0.98	0.02	0.08	4.98
30	0.36	0.03	2.61	0.02	0.17	8.59
60	0.40	0.10	2.45	0.03	0.18	9.41
90	0.60	0.10	3.24	0.06	0.20	12.94
120	0.33	0.06	2.13	0.04	0.10	9.77
Mean	0.39	0.07	2.28	0.04	0.16	7.13
			Unfortified	Organic	Fertilizer	
0	0.30	0.07	0.98	0.02	0.08	4.98
30	0.37	0.02	1.14	0.02	0.16	9.76
60	0.54	0.10	4.06	0.02	0.21	10.60
90	0.71	0.12	6.29	0.08	0.24	15.74
120	0.48	0.04	2.78	0.04	0.14	12.58
Mean	0.54	0.05	3.50	0.04	0.17	12.73

Proximate analysis of onion bulb

The proximate quality of onion bulb was significantly ($P \leq 0.05$) affected by fortified and unfortified sunshine fertilizer at different application rate. The crude protein; crude fiber; moisture content; ash; fat and vitamin C of onion bulb were influenced by fortified and unfortified sunshine fertilizer at different application levels. Onion plant treated with unfortified sunshine fertilizer gave better proximate constitution of onion bulb than fortified sunshine fertilizer treated plant. Application of unfortified fertilizer at 90 kg /ha gave the best crude protein (CP) content of onion bulb (3.24 mg/100g) while onion bulb harvested from plot treated with fortified sunshine fertilizer at the rate of 60kg / ha produced onion bulb with

the highest crude protein content (2.40 mg/100g) while the lowest CP content was obtained from onion planted to control. The crude fiber content in onion bulb was influenced by fertilizer and at different application rate; unfortified sunshine fertilizer had higher value (0.98) compared to fortified sunshine fertilizer (0.92). At the rate of 30 kg ha^{-1} fortified fertilizer and unfortified sunshine fertilizer had the highest crude fiber content (1.18 mg/100g and 1.50 mg/100g respectively) while reduction was recorded at the increase of fertilizer rate for both types. Fertilizer application affected the moisture content of onion bulb. Unfortified sunshine fertilizer gave higher mean moisture content in onion bulb (21.08) while fortified fertilizer had (12.49). Application of unfortified fertilizer at 90kg ha^{-1} gave the best moisture content of onion bulb (34.11 mg/100g) while onion bulb harvested from plot treated with fortified sunshine fertilizer at the rate of 60kg ha^{-1} produced onion bulb with the highest moisture content (24.22 mg/100g).The lowest moisture content was obtained from onion grown on the control plots. Application of unfortified fertilizer at 90kg ha^{-1} gave the best fat content of onion bulb (0.34 mg/100g) while onion bulb harvested from plot treated with fortified sunshine fertilizer at the rate of 90kg ha^{-1} produced highest fat value in onion bulb (0.31 mg/100g). The lowest fat content was obtained from onion planted to control. Among the fertilizer types, unfortified fertilizer produced onion bulb with higher fat than fortified sunshine fertilizer. The ash content in onion bulb was influenced by fertilizer and at different application rate; unfortified sunshine fertilizer had higher value (0.79) compared to fortified sunshine fertilizer (0.71). At the rate of 60 kg ha^{-1} fortified fertilizer recorded the best ash content (0.88) while unfortified sunshine fertilizer had the highest ash content at the rate of 90kg ha^{-1} (0.93 mg/100g) while reduction was recorded at the increase of fertilizer rate for both types. The least was recorded in unfertilized plot. Fertilizer application affected the vitamin C content of onion bulb. Unfortified sunshine fertilizer gave higher mean vitamin c content in onion bulb (10.27) while fortified fertilizer had (10.25). Application of unfortified fertilizer at the rate of 90 kg ha^{-1} gave the best vitamin c content of onion bulb (11.28 mg/100g) while onion bulb harvested from plot treated with fortified sunshine fertilizer at the rate of 60kg/ha produced onion bulb with the highest moisture content (12.84 mg/100g). The lowest moisture content was obtained from onion planted to control.

Proximate Analysis of onion leaf

The proximate quality of onion leaf was significantly ($P \leq 0.05$) affected by fortified and unfortified sunshine fertilizer at different application rate (table 2). The crude protein; crude fiber; moisture content; ash; fat and vitamin c of onion leaf were influenced by fortified and unfortified sunshine fertilizer at different application rates. Onion plant treated with

unfortified sunshine fertilizer gave better crude protein, moisture content, ash and vitamin c while fortified sunshine recorded higher crude fiber. Both fertilizer types had similar result in respect to fat content of onion leaf.

Control gave the best crude protein (CP) content of onion leaf (0.60 mg/100g) in both fertilizer types while fertilizer applied at the rate of 120kg ha^{-1} had least crude protein in onion leaf from both varieties. Onion leaf harvested from plot treated with unfortified sunshine fertilizer produced the highest crude protein content (0.54 mg/100g). The crude fiber content in onion bulb was influenced by fertilizer and application rate (table 7) fortified sunshine fertilizer had higher mean value of crude fiber (0.07) compared to unfortified sunshine fertilizer (0.05). The pot that had 30 kg ha^{-1} and 60kg ha^{-1} fortified fertilizer and unfortified fertilizer gave similar result, (0.10 and 0.02, respectively) and unfortified sunshine fertilizer had the highest crude fiber content (0.18 mg/100g and 1.50 mg/100g respectively) while reduction was recorded at the increase of fertilizer rate for both types. The unfertilized pot had the least. Fertilizer application affected the moisture content of onion bulb (table 6). Unfortified sunshine fertilizer gave higher mean moisture content in onion bulb (21.08) while fortified fertilizer had (12.49). Application of unfortified fertilizer at 90 kg/ha gave the best moisture content of onion bulb (34.11 mg/100g) while onion bulb harvested from plot treated with fortified sunshine fertilizer at the rate of 60kg ha^{-1} produced the highest moisture content (24.22 mg/100g).The least moisture content was recorded in control (unfertilized plot). The lowest moisture content was obtained from onion planted to control. Application of unfortified fertilizer at 90 kg ha^{-1} gave the best fat content of onion bulb (0.34 mg/100g) while onion bulb harvested from plot treated with fortified sunshine fertilizer at the rate of 90kg N ha^{-1} produced highest fat value in onion bulb (0.31 mg/100g). The lowest fat content was obtained from onion planted to control. Among the fertilizer types, unfortified fertilizer produced onion bulb with higher fat than fortified sunshine fertilizer. The ash content in onion bulb was influenced by fertilizer and at different application rates (table 6) unfortified sunshine fertilizer had higher mean value (0.79) compared to fortified sunshine fertilizer (0.71). The pot that had 60 kg ha^{-1} fortified fertilizer recorded the best ash content (0.88) while unfortified sunshine fertilizer had the highest ash content at the rate of 90kg ha^{-1} (0.93 mg/100g) while reduction was recorded at the increase of fertilizer rate for both types. The lowest ash content was obtained from onion planted in unfortified pot. Fertilizer application affected the vitamin C content of onion bulb (table 6). Unfortified sunshine fertilizer gave higher mean vitamin C content in onion bulb (10.27) while fortified fertilizer had (10.25). Application of unfortified fertilizer at the rate of 90 kg N ha^{-1} gave the best vitamin C content

of onion bulb (11.28 mg/100g) while onion bulb harvested from pot treated with fortified sunshine fertilizer that had 60kg/ha produced onion bulb with the highest moisture content (12.84 mg/100g). The lowest moisture content was obtained from onion planted to control.

CONCLUSION

In conclusion, the best fertilizer type and rate under this investigation for maximum yield and nutritional value of onion are unfortified sunshine organic fertilizer applied at 90kg /ha.

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