International Journal of Agricultural Science Research Vol. 4(7), pp. 140-145, July 2015
Available online at http://academeresearchjournals.org/journal/ijasr
ISSN 2327-3321 ©2015 Academe Research Journals

Full Length Research Paper

Influence of planting techniques and potting media on the growth and yield of onion (*Allium cepa* L)

Nwokwu, G.N* and Ekwu, L.G

Department of Crop Production and Landscape Management, Faculty of Agriculture and Natural Resources Management, Ebonyi State University, P.M.B 053, Abakaliki, Nigeria.

Accepted 1 June, 2015

An experiment was conducted in 2010 to determine the influence of planting techniques and different potting media on the growth and yield of onion (*Allium cepa* L) in the screen house of the Department of Crop Production, and Landscape Management, Ebonyi State University, Abakaliki, Nigeria. The experimental design was a 2×8 factorial experiment in a completely randomized design (CRD). The treatment used were two planting techniques (transplanting and direct seeding) and eight potting media mixture such as T1= sandy soil (control), T2= burnt rice husk + poultry manure + municipal waste at ratio of 1:1:1, T3= burnt rice husk + poultry manure + municipal waste at ratio of 2:2:1, T4= municipal waste + poultry manure + burnt rice husk at ratio of 2:2:1, T5= swine manure + municipal waste + poultry manure at ratio of 2:2:1, T6= swine manure + municipal waste at ratio of 4:1, T7= poultry manure + swine manure at ratio of 4:1 and T8= burnt rice husk + poultry manure at ratio of 4:1. The treatments were replicated three times with each replication having 16 pots that gave a total of 48 experimental pots. The pots were irrigated twice daily (morning and evening) to make moisture available for the plants. Agronomic characteristics measured were: leaf length, number of leaves, bulb diameter, fresh weight of bulb, total yield, root length, number of bulb, etc. The results indicated that both potting media and planting techniques have significant (p=0.05) effect on leaf length, number of leaves, number of bulb, bulb diameter and root length. Fresh weight of leaves, fresh weight of bulb and total yield recorded non-significant difference in both treatments. Transplant technique gave the highest value in all the parameters except fresh weight of bulb, while direct seeding techniques recorded the least results. Also, T5 (swine manure + municipal waste + poultry manure) recorded the highest value in most of the parameters under study except number of leaves and root length, while T1 (control) and T8 (burnt rice husk + poultry manure) gave the least results.

Key words: Potting media, planting techniques, onion, growth, yield.

INTRODUCTION

Onions (*Allium cepa* L.) is a member of the Alliaceae family and it is one of the most important vegetables in the world whose utility is ranked second to tomatoes (Brice et al., 1997). It is a vegetable that is widely consumed due to its flavouring and health-promoting properties. It is a major spice item and ranks among the top five vegetables in Nigeria (NIHORT, 1986). Onions can be eaten raw, in salad, fried, boiled or roasted and also used in flavouring soup, canned food products and other savoury dishes (Hussain et al., 2000). Onion is rich in phosphorus, calcium and carbohydrate (Gambo et al., 2008). According to Mike (1997), a medium onion (50 g in weight) contains 60 kg calories, 1 g protein, 16 g carbohydrate, no fat, 5 ml sodium, 200 ml potassium, 3 g dietary fibre, etc. In Nigeria, onions production is limited to the northern part of the country, and its production is limited to Fadama areas and grown mostly during dry season under irrigation (Kaynas et al., 1990). *A. cepa* L is

*Corresponding author. E-mail: g.nwokwu@yahoo.com.

a delicate and perishable commodity, hence difficult to store for long duration at room temperature especially in tropical and sub-tropical countries due to its high water content (Shinda and Sontakke, 1990). The day length requirement for onions varies from 11-16 h (Yassen and Khalid, 2009).

The problems of onion production like every other vegetable crop are limited land resources that are low in fertility and some production techniques employed by the farmers. Cultivation of crop using eco-friendly innovative techniques with sustainable use of resources is the best way to increase production level of food and one of the ways to overcome the soil fertility problem is through pot techniques which are growing of vegetables in pots or poly bags. This is a means of diversification for making agriculture more profitable through efficient land use and maximum utilization of natural resources. Mixture of organic manures such as poultry manure, burnt rice husk and municipal waste are good medium for vegetable crops. Organic manure improves the physical properties of the soil, microbial activity and nutrient availability in growing medium (Snyman et al., 1998). Pierce (1987) also reported that onions can be successfully cultivated in many fertile soils, and low content of organic manure in the dry soil critically affect the onion yield. Organic materials such as poultry dropping, improves soil physical and chemical properties (Ahmed et al., 1990). On the other hand, onions can be direct seeded in the field, transplanted or grown from onion sets (Massiha et al., 2001). But in all, transplanting method is more common than direct sowing in onion production and research in many countries (Brewster, 1990). Transplanting method is beneficial in five ways; it provides better establishment of seedlings, earliness, homogeneous bulb, higher yield and prevents a change in soil structure (Wilkerson et al., 1994). The objectives of this study are to determine the influence of planting techniques and potting media on the growth and yield of onion.

MATERIALS AND METHODS

The experiment was conducted in the Screen House of the Department of Crop Production and Landscape Management, Ebonyi State University, Abakaliki. The experimental deign was a 2×8 factorial experiment in a completely randomized design (CRD). The treatments used were two planting techniques (transplanting and direct seeding) and eight potting media mixture which gave a total of 16 treatment combinations. The treatments were replicated three times with each replication having 16 experimental pots that gave a total of 48 experimental pots. The onions seed was sourced from Jos market in the Northern part of Nigeria. Nursery operation was carried out in the same screen house of the department in modern seed boxes filled with soil mixture of topsoil, organic manure and river sand in the ratio of 3:2:1. Planting of onions was done in a 15 × 15 × 30 cm polypots containing the different media mixtures. After planting, other cultural activities like weeding, irrigation and harvesting were duly carried out. In each stage of growth, an average of the following agronomic characteristics: leaf length, number of leaves, number of bulbs, fresh weight of bulbs, bulbs diameter, root length and total yield, was measured.

Statistical analysis of data collected was based on the procedures for Analysis of Variance (ANOVA) for a completely randomized design (CRD) and mean separation and comparison was carried out using Fishers Least Significant Difference (FLSD) as described by Obi (1986).

The following media were used to formulate the mixtures:

(a) Burnt rice husk (BRH);
(b) Swine manure (SM);
(c) Poultry manure (PM);
(d) Municipal waste (M);
(e) Top soil (TS).

Media formulation

The media were formulated by mixing the above media with one another at different ratios with different weight:

T1 = sandy soil (control);
T2 = Burnt rice husk + poultry manure + municipal waste at ratio of 1:1:1 (2.5+1.5+4.5+2) kg;
T3 = Burnt rice husk + poultry manure + municipal waste at ratio of 2:2:1 (2-5+1.4+4.5) kg;
T4 = Municipal waste + poultry manure + burnt rice husk at ratio of 2:2:1 (4.5+1.5+2.5) kg;
T5 = Swine manure + Municipal waste + poultry manure at ratio of 2:2:1 (2+4.5+1.5) kg;
T6 = Swine manure + Municipal waste at ratio of 4:1 (2+4.5) kg;
T7 = Poultry manure + swine manure at ratio of 4:1 (1.5+2) kg;
T8 = Burnt rice husk + poultry manure at ratio of 4:1 (2.5+1.5) kg.

Two planting techniques were used in this study namely:

DS = Direct sowing;
TT = Transplanting techniques.

RESULTS

Leaf length

There was significant difference (p=0.5) in leaf length among the treatments (Table 1). The difference among the treatments would be due to the different compositions of potting mixture. The result revealed that treatment (T1 and T8) significantly produced the shortest leaf, while

Table 1. Influence of planting techniques and potting media on leaf length.

Treatment	Planting techniques		
Potting media	**Direct seeding**	**Transplanting**	**Means**
T1	23.16	32.77	27.97
T2	35.51	63.19	49.35
T3	31.51	47.49	39.50
T4	36.00	54.78	45.39
T5	46.06	63.08	54.57
T6	27.48	47.53	37.51
T7	26.27	46.97	36.62
T8	19.39	32.97	26.18
Means	30.67	48.60	

F-LSD = (P=0.05). Planting technique = 1.61, Potting media = 1.61, Planting technique × potting media = 0.56.

Table 2. Influence of planting techniques and potting media on number of leaves.

Treatment	Planting techniques		
Potting media	**Direct seeding**	**Transplanting**	**Means**
T1	3.59	3.29	3.44
T2	5.08	13.22	9.15
T3	4.83	8.96	6.90
T4	5.19	10.67	7.93
T5	6.74	10.30	8.52
T6	4.19	9.37	6.78
T7	4.33	9.70	7.02
T8	3.52	7.06	5.29
Means	4.68	9.95	

F-LSD = (P=0.05). Planning technique = 0.82, Potting media = 1.63, Planting technique × potting media = N.S.

treatment (T5) produced the longest leaf. The reason may be the variation in nutrient contents of the media resulting in full decomposition and release of nutrient due to its high C:N ratio. Relatively high levels of nutrients are required for optimum growth and development at early stage and adequate moisture supply is most suitable during the early growth (Tindall, 1968).

Number of leaves

Planting techniques recorded significant difference on the number of leaves. Transplanting techniques recorded highest value when compared to the direct seeding techniques.

The effect of potting media recorded significant difference on the number of leaves. T2 (Burn + rice husk + municipal waste + swine manure) produced the highest number of leaves, while the least value was at T8 (Burn + rice husk + poultry manure).

Planting techniques × potting media interaction produced non-significant difference on number of leaves. However, T2 (Burnt rice husk + municipal waste + swine waste and transplant techniques produced the highest number of leaves, while T8 (Burnt + rice husk + poultry manure) and direct seeding techniques recorded the least value. Number of leaves per plant indicated low values in T1 and T8; these two treatments were not significantly different at p=0.5, but significantly differed from other treatments. The presence of ample quantity of nutrient in T2 and T5 at early stages than others leads to high uptake of major nutrients which might have resulted in better performance in vegetative growth. Also proper decomposition of the nutrients in those media increased the chances of more nutrient availability for proper plant growth. This result was in good accordance with those recorded by other researchers such as El-Desuki et al. (2006), Fawzy et al. (2007) and El-Bassiony (2006). Potassium nutrition has pronounced effect on carbohydrates partitioning by affecting either phloem export of photosynthate or growth of source (leaves) and or sink (bulb) organ (Cakmak et al., 1994). Reduction in number of green leaves might be due to the translocation of food from source to sink and senescence of leaves. During the period of bulb formation, plants cease to produce new leaves (Table 2).

Number of bulb

Planting techniques had significant effect on the number of bulbs. Transplant techniques produced higher number of bulb, than the direct seeding techniques. More so, potting media had significant effect on the number of bulbs. Number of bulbs at T5 (swine manure + municipal waste + poultry manure) was significantly higher than other treatments while T1 (control) gave the least value. On the other hand, potting technique × potting media interaction produced non-significant difference on number of bulbs. The highest number of bulbs was produced at T5 (swine manure + municipal waste + poultry manure) and direct seeding techniques, while the least was at T1 (control) and direct seeding techniques. Onion is a heavy feeder plant and it gives good response to organic manures. Potassium plays an important role in the translocation of photosynthates from source to sink; it increases the photosynthethic rate of crop leaves and facilitates carbon movement (Cakmak et al., 1994). The reason for higher number of bulbs per plant in T5 than any others might be the high uptake of nutrient P and K by plants in the medium. The longest leaves in T5 ensure more leaf area for photosynthesis; this leads to increase in photosynthetic rate and promotes accumulation of food in sink organ which ultimately end up with increase in number of bulblets formed (Table 3).

Fresh weight of bulbs

The results shown in Table 4 indicated that there were no

Table 3. Influence of planting techniques and potting media on number of bulbs.

Treatment	Planting techniques		
Potting media	Direct seeding	Transplanting	Means
T1	2.00	2.67	2.34
T2	3.0	4.0	3.5
T3	2.67	3.00	2.84
T4	2.33	3.33	2.83
T5	4.0	4.00	4.00
T6	2.33	3.00	2.67
T7	2.33	3.33	2.83
T8	2.33	2.64	2.50
Means	2.62	3.22	

F-LSD = (P = 0.05). Planning technique = 0.37, potting media = 0.73, planting technique × potting media = N.S.

Table 4. Influence of planting techniques and potting media on fresh weight of bulbs/plant.

Treatment	Planting techniques (kg)		
Potting media	Direct seeding	Transplanting	Means
T1	0.02	0.08	0.05
T2	0.17	0.22	0.2
T3	0.14	0.13	0.14
T4	0.08	0.20	0.14
T5	0.71	0.17	0.44
T6	0.19	0.10	0.15
T7	0.06	0.13	0.01
T8	0.06	0.17	0.12
Means	0.18	0.15	

F-LSD = (P =0.05). Planting technique = N.S, potting media = N.S, planting technique × potting media = N.S.

significant differences at p=0.05 in fresh weight of bulbs. Planting techniques, potting media and interaction recorded non-significant difference on the fresh weight of bulbs. Direct seeding techniques produced the highest fresh weight of bulbs over transplanting techniques. Moreover, T5 (swine manure + municipal waste + poultry manure) recorded the highest value while the least was at T1 (control). T5 (swine manure + municipal waste + poultry manure) and direct seeding method gave the highest fresh weight of bulbs, while T1 (control) and direct seeding techniques produced the least value.

Bulb diameter

Table 5 shows that the bulb diameter significantly varied (p=0.05) among the treatments at the time of harvesting

Table 5. Influence of planting techniques and potting media on bulbs diameter.

Treatment	Planting techniques (cm)		
Potting media	Direct seeding	Transplanting	Means
T1	1.65	2.61	2.13
T2	2.47	4.71	3.59
T3	2.35	3.34	2.85
T4	4.07	4.48	4.28
T5	3.97	5.28	4.63
T6	3.82	3.87	3.85
T7	1.97	3.60	2.79
T8	1.39	2.26	1.83
Means	2.71	3.71	

F-LSD = (P = 0.05). Planting technique = 0.49, potting media = 0.98, planting technique × potting media = N.S.

and average bulb diameter ranges from 1.83 to 4.63 cm. Planting techniques and potting media produced significant difference on bulb diameter, while the interaction recorded non-significant difference. Transplant techniques recorded the highest bulb diameter, while direct seeding gave the least value. Also, T5 (swine manure + municipal waste + poultry manure) produced the highest bulb diameter. T8 (burnt rice husk + poultry manure) gave the least value. However, planting techniques + potting media interaction recorded the highest value at T3 (burnt rice husk + poultry manure + municipal waste) and transplant techniques. T8 and direct seeding techniques gave the least value. Increase in food accumulation may have contributed to increase in bulb diameter. This is in agreement with increasing K uptake which leads to increase in accumulation of carbohydrates and pungency of onion (Singh and Verma, 2001).

Root length

Planting techniques produced significant difference on the root length. The transplant techniques produced the highest root length followed by direct seeding techniques. More so, the result showed that potting media produced significant effect on root length. The longest roots were recorded at T7 (swine and poultry manure), while the shortest roots were at T1 (control). The interaction of planting techniques × potting media recorded significant difference on root length. T7 and direct seeding produced the highest value while the least was at T1 and direct seeding method (Table 6).

Total yield

It was noted that there was significant difference (p=0.05) in total yield among the treatments (Table 7). Number of

Table 6. Influence of planting techniques and potting media on length of roots.

Treatment	Planting techniques (cm)		
Potting media	**Direct seeding**	**Transplanting**	**Means**
T1	2.17	2.73	2.46
T2	4.09	6.68	5.39
T3	6.49	4.53	5.51
T4	1.88	4.69	3.29
T5	4.10	6.66	5.38
T6	2.74	5.30	4.02
T7	12.49	9.49	10.99
T8	2.73	7.34	5.04
Means	4.59	5.93	

F-LSD = (P =0.05). Planting technique = 0.98, potting media = 1.96, planting techniques × potting media = 0.70.

Table 7. Influence of planting techniques and potting media on total yield.

Treatment	Planting techniques (t/ha)		
Potting media	**Direct seeding**	**Transplanting**	**Means**
T1	4.08	5. 15	4.62
T2	3.47	6.08	4.78
T3	5.32	4.67	4.100
T4	3.63	5.10	4.37
T5	4.58	5.20	4.89
T6	5.24	6.45	5.85
T7	6.13	6.22	6.18
T8	3.10	4.45	3.78
Means	5.07	5.55	

F-LSD = (P = 0.05). Planting technique = N.S, potting media = 8.39, planting technique × potting media = 2.97.

bulbs and leaf length contributed to increase in total yield of the onions. Potting media at T5 (swine manure + municipal waste + poultry manure) produced the highest yield while the least total yield was recorded at T1 (control). Equally, planting techniques and their interaction recorded non-significant difference on total yield. Transplant techniques produced higher yield than direct seeding techniques. Also, T5 and direct seeding produced the highest total yield, while T1 and direct seeding gave the least value. Potassium nutrition has pronounced effect on carbohydrates partitioning by affecting either phloem export of photosynthate or growth of source (leaves) and or sink (bulb) organ (Cakmak et al., 1994). Also, increase in food accumulation may have contributed to increase in bulb diameter. This is in agreement with increasing K uptake leads to increase in accumulation of carbohydrates and pungency of onion (Sigh and Verma, 2001).

Conclusion

In this experiment, the results clearly indicated that growth and yield performance of onions grown in pots were affected by the composition of potting media and planting techniques. Onions planted in the medium containing swine manure + municipal waste + poultry manure at the ratio of 2:2:1 showed best performance and gave the highest bulb yield. These mixtures promoted nutrient contents medium and nutrient uptake by plant which ultimately enhanced onion bulb yield. Transplanted onions also performed better both in growth and yield of the onion bulbs.

REFERENCES

Ahmed KGM, Mahdy AMM, Abo-Elyazd EB, Abd El-Momen SM (1990).Effect of soaking onion transplants in growth regulators on the percentage of infection with neck rot disease and chemical contents of onions bulb. Annals of Agricultural science, Moshtoho; 28: 2187-2199.

Brewster JC (1990). The influence of cultural and environmental factors on the time of maturity of bulb onions crops. Acta Horticultural, 267: 286-296.

Brice J, Currahl, Macins A, Bancroft R (1997). Onion storage in the tropics. A practical guide to methods of storage and their selection. Chartham U.K. National Resources Institute, P.3.

Cakmak I, Hengeler C, Marschner H (1994). Partitioning of shoot and root dry matter and carbohydrates in bean plants suffering from phosphorus, potassium and magnessium deficiency . J. Exp. Bot., 45 (12):45-50.

El-Bassiony AM (2006). Effect of potassium fertilization on growth, yield and quality of onion Plant. J. Appl. Sci. Res., 2 (10):780-785.

El-Desuki M, Abdel-Mouty MM, Ali AH (2006). Response of onion plants to additional dose Of potassium application. J. Appl.Sci. Res; 2 (9): 592-597.

Fawzy ZF, El-Nemar MA, Saleh SA (2007). Influence of levels and Methods of potassium fertilizer application on growth and yield of eggplant. J. Appl.Sci.Res; 3 (1): 42-49.

Gambo BA, Magaji MD, Yakubu AI, Dikko AU (2008). Effect of farmyard manure, nitrogen and weed interference on the growth and yield of onion (Allium cepa L.) at the Sokoto River valley. Journal of sustainable development in Agriculture and environment. Vol. 3(2): 87-92.

Hussain UA, Rahaman AA, Aliyu L, Ahmed A, Amans EB (2000). Yield, bulb size distribution and storability of onions (Allium cepa L) under different levels of nitrogen Fertilization and soil moisture regime. Nigeria J. Hort. Sci. vol. 5: 45-50

Kaynas S, lnan Y (1990).Studies on the post-harvest physiology of some imported onion Varieties III (in Turkish) ANN. Rep. Ateturk Hort. Res. Inst. Yaliva.

Massiha IS, Motalslebi A, Shekari F (2001). Effect of Different sowing methods on yield bulb characteristics of onions (Allium cepa L) Acta agronoica Hungarica, 49(2): 169-174.

Mike S (1997)Soilless media inhorticulture. Hort FACT P.4micro J. Gil. LANSFUS, c.1991.Eeffect of leaf damage on onions yield. Onions Newsletter for the tropics 3: 21-23.

NIHORT (1986). National Horticultural Research institute, Jericho Ibadan. Annual Report.

Obi IU (1986). Statistical method of dictating difference, between means SNAAP press, Enugu, Nigeria 45pp ISBN 978-978-099x.

Pierce LC (1987). Vegetables characteristics, production and marketing Wiley press, New York, USA.

Shinda NN, Sontakke MB (1990) In vegetables of India, Eds T.K. Bose and M.G. Som. Calcutta naya piokash, 545 – 582.

Singh PP, Verma AB (2001). Response of onion (*Allium cepa* L.) to potassium application. J. Agron., India, 46 (1): 182-185.

Snyman HG, Jong DF, Aveling TAS (1998). The stabilization of sewage sludge applied to Agricultural land and the effects on maize seedling water science technology, 38 (2): 87-95.

Tindall HD (1968). Commerical vegetable growing. Tropical hand book series, Oxford University press. Oxford.

Wilkerson DL, Barnes BD, Hall C (1994). The Texas poinsettia produces Guide: selecting a Growing media. Texas Agricultural Extension service Greenhouse Bulletin.

Yassen AA, Khalid KH (2009). Influence of organic fertilizers on the yield, essential oil and mineral content of onions. Int. Agro. Phys., 23,183-188.