ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

PERFORMANCE AND ADAPTABILITY OF TWO YAM (*Dioscerea Spp*) VARIETIIES UNDER IFUGAO CONDITION

*** Chiemela F. Anyanwu, and Ricardo L. Ildefonso**
Ifugao State University, Potia Campus, Alfonso Lista, Ifugao, Philippines.

Manuscript Info

Manuscript History:

Received: 14 May 2015
Final Accepted: 22 June 2015
Published Online: July 2015

Key words:

Yam, *Dioscorea alata*, reddish purple flesh , reddish white flesh, Kinampay

Corresponding Author

Chiemela F. Anyanwu

Abstract

In the context of declining trend in yield output of yam (*Dioscorea alata*) in the Philippines in spite of high demand for export and domestic consumption, two preferred local varieties of *D. alata* (Kinampay - reddish purple flesh and reddish white flesh) was evaluated under Alfonso Lista Ifugao climatic condition for their adaptation and growth performance for yield. The experiment was laid out in randomized complete block design (RCBD) with two treatments representing the varieties and replicated four times. The result showed that the two varieties evaluated were suitable for planting in the experimental area (Potia, Alfonso Lista Ifugao). However, the purple variety recorded an average of 53.20 (days to emergency), 3.50 (vines per hill (4WAP), 68.25 cm (vine length) and 87.29% (disease resistance). This vigorous growth produced averaged tuber fresh weight of (3.95kilogrm), and a total yield of (18.25 kg/ha).

INTRODUCTION

Yam (*Dioscorea alata*) is among the staple food in many tropical and subtropical regions of the world. Around the world, growing regions includes; West Africa, South America and Asia. (Coursey, 1967; Ayensu and Coursey, 1972). Yam world production is estimated at 52 million metric tons planted in more than 5 million hectares in 57 countries worldwide, 95 percent of which is produced particularly in West Africa (FAO statistics 2004).

In South East Asia, particularly in the Philippines, production is mainly concentrated in the regions of Ilocos, Southern Tagalog, Bicol, Central Visayas, and Northern Mindanao with annual production estimated at 15 metric tons. A declining trend in ube/ubi (Philippines) production has been observed with output dropping to 15,799 metric tons (MT) in 2012 from 30,074 MT in 2006 (BAS- 2004).

Yam is a perennial climbing herb with flesh colors ranging from white to yellow, orange, red and deep purple. Studies have shown that yam grows favorably in a wide range of soil types and elevations because of its tolerance to adverse conditions such as droughts and pest infestations (Onwueme ,1978). However, it thrives best in well-drained sandy loam or silt loam soil, with an average temperature ranging from 25°C to 30°C. Photoperiodism is a factor that has been identified that encourages yam productiona. A short-day length is favorable for yam root growth while a long-day length is ideal for vine growth and high light intensity is generally required for yam cultivation (DA-Agriculture Monthly Magazine, 2001; Otoo_et al., 1985). Studies have also indicated that yam can be intercropped with other crops such as legumes and vegetables (Nweke et al., 1991: Ramirez and Rodriguez, 1975; Bai and Ekanayake, 1998).

In the Philippines, yam is planted during the months of March and June and harvested from December to February (DA-Agriculture Monthly Magazine July, 2001). Popular varieties planted in the growing regions includes; Florido, Kabus-ok, Kinabayo, Kinampay, Basco, Zambal and Leyte. These varieties have potential yields from 10 to 56 metric tons /ha.

Yam is a major source of ingredient for culinary making. It is used by major food entrepreneurs to make jams, purees, flavoring for ice cream and yogurt. Bakeries also use it as filling for hopia, cakes, pastries, and breads (Agriculture Magazine July, 2001). Flour and starch can also be produced from yam, a product of high industrial value. Studies have shown that yam contains substances that can lower blood sugar level as well as improvement of metabolic activity and also provides adequate antioxidant defenses against cancer. (PCHRD-DOST Bulletin, 2011). Yam tubers also contain alkaloids (sapogenins) which have genuine medicinal value and are used in many pharmaceutical preparations (Degras, 1993; Ramberg and Nugent, 2002)

Potentials for yam industry to grow in the Philippines are high because of the industrial food sector's growing demand for local as well as foreign market. Yam has been tagged as one of the Philippine's banner crops for export by the Department of Trade and Industry (DTI). Market analysis studies on yam production indicate a low level especially for yam varieties preferred for industrial processing. Low level of yam production in the Philippines has been attributed to many factors such as; poor management and production practices, lack of high yielding varieties and the use of poor planting material (setts). (Research Highlights 2000-2003; Bar digest, 2009; BAS, 2004).

The processing industry that leads in the demand for yam has preferred varieties for their industrial productions. One such variety in the Philippine is known as *Kinampay*, which has a roundish shape and purple flesh, excellent aroma, good adaptation performance, with tubers weight from 2- 4kg and yields up to 21-26 ton/ha as well as slightly resistance to dieseas. According to Nweke et.al. (1991), adaptation and agronomic performance of a crop in terms of growth, yield and disease resistance is an important criteria for crop selection and sustainability.

It is for this reason that this research was conducted to evaluation the adaptation and performance in terms of agronomic characteristics of two yam preferred varieties so as to expand their cultivation, optimize production practices and increase outputs to meet the growing demand.

Material and Methods

Location/study area

The study was conducted at the Ifugao State University College of Agriculture and Forestry Experimental Site (16°56'36"N, 121°28'59"E), (Figure 1), The study area is characterized by a tropical climate with distinctive wet and dry seasons with average annual temperature of 20°C to 35°C and average rainfall of 1887 mm. The characteristics of the soil at the experimental site was categorized as a well drain loam soil, with a pH of 6 considered tolerable for yam cultivation (Table 1.)

Experimental design

Land Preparation

An area measuring three hundred square meter was cleared and prepared by ploughing at the experimental site. One hundred and fifty square meters was laid out as the experimental area following a randomized complete block design (RCBD) with two treatments representing the two varieties and replicated four times. Each replication had 20 hills per row with a distance of 50 cm between rows and 75 centimeter between hills.

Sett Preparation

Tubers of two popular varieties (T1- reddish purple flesh, T2 - reddish white flesh) were prepared in setts of 4 inches. The cuts were submerged in fungicide solution and sun-dry until cuts are dried, cut sett were subsequently cured for one day before planting.

Planting

The setts were planted at the rate of one sett per hole by placing the skin surface downward at the center of hole. The holes were filled with two kilograms of organic fertilizer. The planted setts were regularly watered to maintain adequate moisture. Rice straws were used for mulching as well as for weed control.

Staking and Maintenance

Stakes were erected using bamboo sticks measuring three meter long for the vines. The vines were regularly trained. Weeds were removed regularly. Plants were fertilized at the rate of 30 gram per hill forty days after planting (DAP) and subsequent application was carried out after three months.

Data collection

Pest and disease infestation were observed and recorded. Growth in height increment after emergency were determined weekly with a meter stick until the 8th week. Number of vines per hill was counted up to 4WAP. The percentage of plant survival were determined by counting the number of hills with harvest per treatment and divided by the number of experimental plant per variety/ per row and multiplied by 100 percent. Yield variable were determined at harvest.

Data collected were subjected to analysis of variance. The results were presented as mean values and separated using Duncan's Multiple Range Test (DMRT).

Figure 1: Map of the study location

Table 1: Physical and chemical properties of soil from the experimental site before planting

pH	6.5
Nitrogen	15.87ppm
Phosphorus	37.08ppm
Potassium	3.56/100g
Textural class	Loam soil
Mean temperature	25°C to 35°C
Rain fall pattern	Fairly distributed

Result and Discussion

Growth variables

Results of growth variables for the two yam varieties studied are presented in table 1. The results shows that there are no significant difference (p< 0.05%) in the days of emergency, number of vines per hill, length of vine (growth increment) and disease resistance. But a significant difference was observed in the percentage of plant survival (85.26%, 75.20%). This may be attributed to environmental factors prevailing in the experimental area during the period of production. In a similar study, Sotomayor-Ramirez et al., (2003) reported that photosynthetic rate and assimilate partitioning depend strongly on the developmental stages of yam, vine increment, intercepted solar radiation, root elongation as well as environmental factor such as soil fertility and water supply. However, the observed patterns in growth variables for the two varieties indicated a fairly adaptation to the environmental conditions in the experimental area. It was also observed that the reddish purple flesh variety exhibited vigorous growth pattern than the reddish white flesh variety with average of 53.20 (days to emergency), 3.50 (vines per hill (4WAP), 68.25 cm (vine length) and 87.29% (disease resistance) (Figure 1).

Growth response of yam may be affected by many factors such as climatic conditions, cultural practices and soil fertility (Ndegwe et al, 199). It has also been observed that vigorous vine growth is an indicator that ensures maximum interception of light by the leaves to promote growth and yield (Alvarez and Hahn, 1984; King and Risimeri, 1992). According to Onwueme (1978), the balance between source (leaves) and sink (tubers) is a determining factor in yam tuber yield.

In this study, it was observed that no major pest and disease attack occurred during the experimental period. Hence; vine growth attained a maximum growth length to initiate tuber formation. As reported by Diby et. al, (2009), tuber formation in yam is highly influence by rapid vine growth.

Yield Variables

Results of yield variables for the two yam varieties are presented in table 2. The results show that there was no significant difference (p< 0.05%) in most of the yield variables: number of tubers per hill, length of tuber, percent marketable tubers, weight of marketable tubers. However, there was a significant difference in the tuber fresh weight, and total yield per variety at harvest (310DAP). One important criterion for yam production is varietal performance in terms of yield variables. The ultimate goal in yam production is to achieve high yield for economic gain. Thus a variety that is capable of producing quality tubers with substantial marketable weight will be preferred (Olasantan, 2007; Orkwor and Ekanayake, 1998).

In this study, the purple flesh variety produced average tuber fresh weight of (3.95kilogrm), and a total yield of (18.25 kg/ha), while the reddish white flesh variety produced average tuber fresh weight of (1.85kg) and total harvest weight of (13.25 kg/ha) (Figure 2). These values are in line with the results obtained by other authors (Provincial Govt of La Union and DA, 2004; Ferguson, 1980; Ettien et al. 2009; Diby et al. 2009; Eruola et al. 2012). Quantitatively, in terms of production capacity, these values confirm a good adaptation of (*D. alata)* to the prevailing environmental conditions of the experimental area.

.

Figure 2. Yam vines and tubers

As reported by Ettien et al. 2009; Diby et al. 2009, a favorably environmental condition is a determinant for yam tuber formation and yield. Soil fertility is also an important factor for tuber formation (Nweke et.al 1991). According to NRI, (1987), between 20 and 30 tons per hectare of yam tubers can be obtained, and up to 55 tons per hectare on fertile soils. As further stated by Rodriguez-Montero, (1997), tuber yield in yam is mainly determined by the total biomass production and its partitioning between the various plant organs.

In this study, performance of the yam varieties in terms of agronomic characteristics may be attributed to the low incidence of pest and disease occurrence that was observed during the production period. According to Sotomayor-Ramirez et al. (2003), pest and disease occurrence limits vine growth and affects tuber formation.

Conclusions

The two yam varieties evaluated in this study showed a promising environmental adaptation to the experimental area (Alfonso Lista, Ifugao). This is indicated by the good performance in terms of growth and yield. From this study, we conclude that the two yam varieties, (Kinampay) reddish purple flesh, and reddish white flesh exhibited vigorous growth patterns and produced high percentage of marketable tubers as well as total harvest yield per hectare. Therefore, these varieties are suggested to be commercially exploited by farmers in the area of Alfonso Lista and the neighboring municipalities with similar environmental conditions.

Table 1. Mean growth variables of yam

Treatment/Variety	Average Days of Emergence	Number of Vines per hill	Length of Vine (Growth Increment (cm) (4WAP)	Percentage of Plant Survival (8 WAP)	Disease occurrence (%)
Kinampay	*ns*	*ns*	*ns*	*	*ns*
T1- reddish purple flesh	53.20	3.50	68.25	85.26	87.29
T2 - reddish white flesh	58.36	2.55	48.26	75.20	83.20

*Each value is a mean of three replicates; *Significant* at $P < 0.05$; ns – not significant

Table 2. Mean yield variables of yam

Treatment/Variety	No of Tubers per Hill	Tuber Length (cm)	Tuber Diameter (cm)	Tuber Fresh Weight (kg) (FW)	Percent Marketable tubers at Harvest (NO)	Percent Marketable Tuber at harvest (WT)	Total yield per variety at harvest ($t\ ha^{-1}$)
Kinampay	*ns*	*ns*	*ns*	*	*ns*	*ns*	*
T1- reddish purple flesh	3.95	19.25	16.60	3.95	45.55	55.42	18.25
T2 - reddish white flesh	2.85	18.75	15.20	1.85	41.25	51.25	13.25

*Each value is a mean of three replicates; *Significant* at $P < 0.05$; ns – not significant

Acknowledgement

The authors wish to acknowledge the Research and Development Department (RDET), Ifugao State University, Nayon, Lamut, Ifugao for funding the study

References

Alvarez, M.N. and Hahn, S.K. (1984). Seed yam production in Tropical Root Crops Production and uses in Africa/edited by Terry, E.R. Doku, E.V. Arene-O.B. Mahungu Ottawa. Canada, IDRC, 129-132.

Bai and Ekanayake, (1998). Taxonomy, morphology and ¯oral biology. In Food Yams: Advances in Research, 13±37 (Eds G. C. Orkwor, R. Asiedu & I. J. Ekanyake). Ibadan: IITA/Root Crops Research Institute.

Below EF (2001). Nitrogen Metabolism and Crop Productivity, In M. Pessarakli (eds) Handbook of Plant and Crop Physiology. University of Arisona, Tucson, Arizona pp. 345-401.

Bureau of Agricultural Digest Philippines (Bar digest) January-March 2009 Volume 11 Issue No. 1.

Bureau of Agricultural Statistics (BAS). Bureau of Agricultural Statistics, 2002. National Root Crops R & D/E Agenda 2002.Investment Policy Framework and Indicative Investment Plan for Root Crops R D/E (2001-2020).

Coursey DG. , (1982). The origins and domestication of yams in Africa. In: Origin of African plant domestication. Edited by: J.R. Harlan, J.M.J. De Wet. A.B.L.

Coursey DG. (1967) The origins and domestication of yams in Africa. In: Origin of African plant domestication. Edited by: J.R. Harlan, J.M.J. De Wet. A.B.L.

Department of Agriculture Monthly Magazine (Philippines), Vol. V No. 7 July 2001

Degras, L. (1993). The Yam. A Tropical Root Crop. London: Macmillan.11. Research Highlights 2000-2003.

Diby NL, Hgaza VK, Tie Bi T, Assa A, Carsky R, Girardin O, Frossard E (2009). Productivity of yams (Dioscorea spp.) as affected by soil fertility. J. Anim. Plant Sci. 5(2): 494-506.

Eruola A. O. , Bello N. J. , Ufoegbune G. C. , Makinde A. A. (2012). Effect of Variety Selection on Growth, Development and Yield of White Yam in Southwestern Nigeria. International Journal of Agriculture and Forestry 2012; 2(3): 101-104

Ettien DJB, Kone B, Kouadio KKH, Kouadio NE, Yao-Kouame A, Girardin O (**2009).** Fertilisation minerale des ferralsols pour la production d'igname en zone de Savane Guineenne de l'Afrique del'Ouest: cas des varietes d'igname traditionnelles sur dystric ferralsols du centre de la Côte d'Ivoire. J. Appl. Biosci. 23: 1394-1402.

Ferguson, T.U. (1980). Agronomic aspects of yam production in the common wealth Caribbean. In yams, International Seminar pointe-a-pitre 28 INRA, 49-59.

Food and Agriculture Organisation (FAO) 2004. Online Statistical Database. Rome, Italy: Food and Agriculture Organization of the United Nations.

King, G.A . and Risimeri J.B. (1992) .Effects of planting density, height of staking and variety on yield and yield components of the lesser yam (Dioscorea esculenta). Tropical Agriculture, 69:129-132,

Law-Ogbomo , K.E. (2007). Agronomic evaluation of white yam (*Dioscorea rotundata* Poir) in different ecological zones of Edo State, Nigeria. Ph.D Thesis, University of Benin, Benin City, Nigeria., Pp: 154.

Ndegwe, N.A., Ikpe, F.N., Gbosi , S.D. and Jaja, E.T. (1990). Effect of staking method on yield and its components in solecropped white Guinea yam (*Dioscorea rotundata* Poir.) in a high-rainfall area of Nigeria. Tropical Agriculture**,** 67:29-32,

NRI, (1987). Root Crops. 2nd edition, pg. 308

Nweke, F.I., Ugwu, **B.O., Adadu, C.L.A., and Ay, P. (1991).** Production costs in the yam based cropping systems of southeastern Nigeria, In Scott, G; Best, R; Rosegrant, M; and Bokanga, M,2000, Roots and Tubers in the Global Food System - A vision statement to the year 2020. CIATCIP-IFPRI-IITA-IPGRI-CIP. 45 p

Olasantan F.O..(2007) Effect of population density and sowing date of pumpkin on soil hydrothermal regime, weed control and crop growth in a yam pumpkin intercrop. Experimental Agriculture 43: 365-380.

Onwueme IC (1978). Sett weight effects on time of tuber formation and on tuber yield characteristics in water yam (Dioscorea alata L.). J. Agric. Sci. 91:317- 319.

Orkwor, G.C. and I.J. Ekanayake, (1998). 'Growth and Development. In: The progress in yam Research.G.C.Orkwor, R. Asiedu and I.J Ekanayake, eds.IITA,Ibadan, Nigeria. pp: 39-62.

Otoo, J. A., Osiru, D. S. O., Ng, S. Y. & Hahn, S. K (1985). Improved Technology for Seed Yam Production. Ibadan: IITA.

Philippine Council for Health Research and Development and, Department of Science and Technology PCHRD-DOST – Philippines Bulletin, 2011.

Ramberg JMS, Nugent S (2002). History and uses of Dioscorea as a Food and Herbal Medicine. Glycosci. Nutr. 3(6): 1-5.

Ramirez OD, Rodriguez JA (1975) Performance of Yam Dioscorea-Spp Cultivars in East Central Puerto-Rico. Journal of Agriculture of the University of Puerto Rico 59, 182-5.

Rodriguez-Montero W (1997). Crop Physiology of the Greater Yam (*Dioscorea alata*), Ulrich E. Grauer. Stuttgart.

Sotomayor-Ramirez D, Gonzales-Velez A, Roman-Paoli E (2003). Yam (Dioscorea spp) response to fertilization in soils of semiarid southern coast of Puerto Rico. J. Agric. Univ. P. R. 87(3-4): 91-103.