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Comparing Cassava Yields in Wetland and Dryland Zones of Nigeria

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Abstract: Multilocational trials were conducted in wetland (Uyo: Swampy Forest Zone, annual rainfall = 2.670 mm) and dryland (Ilorin: Derived Guinea Savanna Zone, annual rainfall = 1.200 mm) in Nigeria to assess the magnitude of the environment on cassava yield. Twelve IITA improved cassava cultivars were grown from 1992 to 1994 in these locations and harvested at 12 months after planting. Results showed there were significant differences between the locations and years for number of tuberous roots per hectare, fresh cassava tuberous root yield per hectare and harvest index. Cassava cultivars grown in the derived guinea savanna zone had the highest for tuberous root number, fresh cassava tuberous root yield and harvest index whereas the lowest were recorded for those grown in the swampy forest zone. Genotypic differences were observed across locations and years for tuberous root number, fresh cassava tuberous root yield and harvest index. In across locations and years, TMS 30572, TMS 82/00058 and TMS 81/00110 had the highest values of 60031, 32 Mg ha^{-1} and 2.1 for total tuberous root number, fresh tuberous root yields and harvest index respectively. The genotypes that performed better than other genotypes at different locations for the parameters measured were: wetland (TMS 30572, TMS 82/00058 and TMS 82/00942) and dryland (TMS 30572, TMS 82/00058 and TMS 81/00110). This study revealed that cassava yield is higher at dryland than wetland among the IITA improved genotypes. Also, similar genotypes performed better either in wetland or dryland zone. Thus, for any screening programme in cassava, aimed at dryland may be useful in wetland zones.

Key words: Wetland · dryland · genotype · cassava · tuberous root yield and harvest index.

INTRODUCTION

Cassava (M*anihot esculenta* Crantz) is the most important root crop in Nigeria [1-3]. It is affected by different environments [3, 4].Recent emphasis on cassava research on a worldwide scale [2, 5] has led to search for cassava cultivars which are high yielding for particular environments [2, 6]. Expansion into new areas, requires basic understanding of the performance of the cultivars in relation to the environment and on whether genotype x environment interactions are important [7].

It has been reported that an improved genotype will have its maximum value in a particular environment [7]. Developing groups of cultivars specifically adapted to different ecological conditions would simultaneously enhance the efficiency of breeding programmes and genetic diversity in cassava [4]. Evenson *et al*. [8] discussed the distinction between genotype stability and adaptability. They reported that a genotype is judged to be stable if, at a given location, its yield varies little. This distinction is important, because a farmer who has to decide the cultivar to adopt, is interested in the stability of the cultivars only at her location for a given yield level. The yield potential of the cultivar at any particular location is of importance to the farmer at that location; that is why breeders are interested in breeding for location specific [7].

Mangrove vegetation is found on flat lands between the high and low tide marks forming transition from land to sea, thus often forming the borderline between the oceans and the tropical rain forest and this area is regarded as wetland [6, 9]. The mangrove swamp forest of the Niger Delta is undergoing major vegetation and land use changes as a result of oil exploration [6, 9]. This area has an annual rainfall that ranges between 1500-2900 mm [6, 9]. The desert encroachment into the rainforest zone is going at a fast rate, this is causing many rainforest zones to become dryland. The derived guinea savannah regions are undergoing drastic changes in environmental factors especially rainfall. The amount of rainfall has reduced

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drastically. The annual rainfall is between 1000-1400 mm [6, 9]. There is need to screen for cassava cultivars that are high yielding and that can be recommended for the farmers in either wetland or dryland areas. The purpose of this research is to compare cassava yields in wetland and dryland agro-ecological zones in Nigeria as well as identify high yielding cultivars.

MATERIALS AND METHODS

Twelve improved IITA cultivars (TMS 30572, TMS 82/00058, TMS 91934, TMS 81/01635, TMS 81/00110, TMS 50395, TMS 82/00942, TMS 30555, TMS 82/00959, TMS 90059 and TMS 4(2)1425) were grown in two locations: Dryland (Ilorin: Derived guinea savannah zone, annual rainfall: 1000-1300 mm, longitude: 03^{l} 50°E, latitude: 07^{l} 52°N, temperature: 30°C, relative humidity: 64-80%) and Wetland (Uyo: Mangrove swamp forest zone, annual rainfall: 1500-2900 mm, longitude: 08^{l} 30°E, latitude: 04 48°N, temperature: 28°C, relative humidity: 68-89%) in Nigeria from 1992 to 1996. The experimental areas were cleared, ploughed, harrowed and ridged using tractor driven plough, harrow and ridger. The experimental design used at each location was the randomized complete block design with four replications. Each plot was 10 m long and 1m apart. Stem cuttings of each 30 cm long and having at least four nodes, were used as planting materials.

At 12 months after planting, harvesting, was done by hand, stems were cut and tuberous roots uprooted from the soil. The tuberous roots were counted. Data collected included: number of tuberous roots per hectare and fresh tuberous root yield per hectare. The harvest index was calculated according to Hunt [10]. Data collected were subjected to statistical analysis using the procedures outlined in the general linear model [11] and mean differences determined by LSD at 5% level of significance.

RESULTS AND DISCUSSION

Combined analyses of variance for total tuberous root number per hectare, fresh tuberous root yield per hectare and harvest index showed significant differences ($P<0.05$) between the two locations (Fig. 1). Cassava genotypes grown in dryland had the highest for tuberous root number, fresh cassava tuberous root yields and harvest index whereas the lowest were recorded for those grown in wetland zone (Fig. 1). This finding suggests the influence of environments on cassava growth and yield. This is, because the derived guinea savanna enjoys more normal and evenly distributed rainfall, a warm climate, fertile soil and sunshine than the mangrove swamp forest zone which has heavy rainfall throughout the year and the soils are waterlogged. This implies that cassava genotype performance or yield will be enhanced by planting in certain locations, since all the genotypes tested produced their highest yield in derived guinea savanna zone when compared to mangrove swamp forest zone. This study suggests that climatic factors in derived guinea savanna zones when adequately harnessed will affect the yield of cassava positively. Since better yields were obtained in the derived guinea savanna, a practical recommendation for growers in Nigeria is to carry out large-scale commercial cassava cultivation in dryland zone.

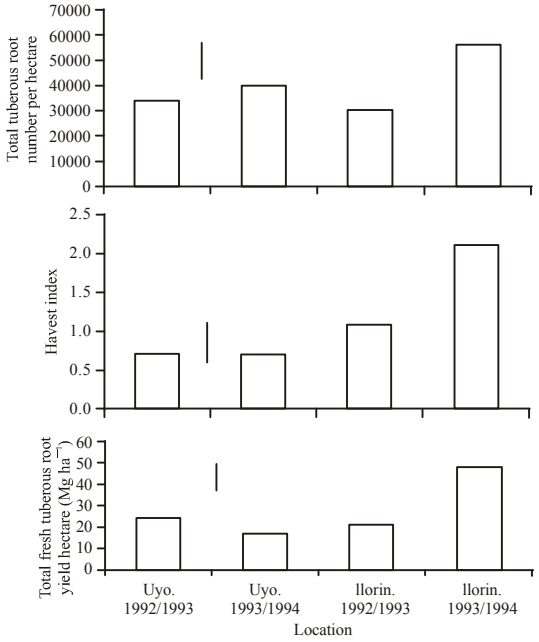

Fig. 1: Effect of locations and years on total fresh tuberous root number per hectare, Harvest index and total fresh tuberous root yield (Mg ha^{-1}) from 1992 to 1996

Genotypic differences were observed across locations and years for the variables studied (Table 1). In across locations and years, TMS 30572, TMS 82/00058 and TMS 81/00110 had the highest values of 60031, 32 Mg ha^{-1} and 2.1 for total tuberous root number, fresh tuberous root yields and harvest index respectively (Table 1). In the dryland zone, TMS 30572, TMS 82/00058 and TMS 81/00110 had the highest mean values for total tuberous root number, fresh tuberous root yields and

Table 1: Combined analysis of dryland (Ilorin) and wetland (Uyo) on total tuberous root number per hectare, fresh tuberous root yield per hectare and harvest index for 12 cassava genotypes from 1992 to 1996

Genotypes	Total tuberous root Number per hectare	Fresh tuberous root yield (Mg ha^{-1})	Harvest index
TMS 30572	60031	28.9	1.2
TMS 91934	48906	26.6	0.7
TMS 81/01635	48250	27.5	1.1
TMS 50395	48813	30.0	0.6
TMS 82/00661	48938	28.8	1.4
TMS 82/00058	52563	32.0	1.0
TMS 81/00110	48844	27.3	2.1
TMS 82/00942	47100	28.9	1.8
TMS 4(2)1425	37625	29.6	0.8
TMS 30555	3315	24.2	1.2
TMS 82/00959	38219	24.4	0.9
TMS 90059	37219	23.6	1.0
L.S.D (0.01)	11603	6.75	1.1

Table 2: Effect of dryland (Ilorin) on total tuberous root number per hectare, fresh tuberous root yield per hectare and harvest index for 12 cassava genotypes from 1992 to 1996

Genotypes	Total tuberous root Number per hectare	Fresh tuberous root yield (Mg ha^{-1})	Harvest index
TMS 30572	62125	36.0	1.7
TMS 91934	59000	38.0	0.7
TMS 81/01635	57375	38.3	1.6
TMS 50395	57313	38.0	0.6
TMS 82/00661	55625	39.0	2.1
TMS 82/00058	54813	42.0	1.3
TMS 81/00110	51875	35.3	3.6
TMS 82/00942	49388	34.0	2.4
TMS 4(2)1425	56375	40.0	0.9
TMS 30555	37000	31.0	1.7
TMS 82/00959	36938	31.0	1.3
TMS 90059	32125	27.0	1.3
L.S.D (0.01)	10735	10.5	1.0

harvest index respectively at 12 months after planting (Table 2). In wetland zone, TMS 30572, TMS 82/00058 and TMS 82/00942 performed better than other genotypes for total tuberous root number, fresh tuberous root yields and harvest index respectively (Table 3). These results indicated that genotypic differences occurred in cassava and some genotypes are high yielding across different locations in Nigeria. This result is in agreement with the finding of Ngeve [4], Dixon *et al.* [7], Otoo *et al*. [12], Akparobi *et al*. [13] and Bueno [14] who reported genotypic differences among cassava. The results of this work have identified some cassava genotypes for cassava growers in derived guinea savanna zone and mangrove

Table 3: Effect of Wetland (Uyo) on total tuberous root number per hectare, fresh tuberous root yield per hectare and harvest index for 12 cassava genotypes from 1992 to 1996

Genotypes	Total tuberous root number per hectare	Fresh tuberous root yield (Mg ha^{-1})	Harvest index
TMS 30572	57938	22.0	0.6
TMS 91934	38813	17.0	0.7
TMS 81/01635	39125	17.0	0.7
TMS 50395	50613	22.0	0.7
TMS 82/00661	42250	19.0	0.7
TMS 82/00058	50313	23.3	0.7
TMS 81/00110	45814	19.0	0.7
TMS 82/00942	44815	23.0	1.3
TMS 4(2)1425	35875	19.0	0.7
TMS 30555	29313	18.0	0.6
TMS 82/00959	39500	18.0	0.6
TMS 90059	42313	20.0	0.7
L.S.D (0.01)	17850	6.3	0.3

swamp forest zone of Nigeria such as TMS 30572 and TMS 82/00058.

In conclusion, significant differences ($P<0.05$) were observed for total tuberous root number, fresh cassava tuberous root yield and harvest index across locations and years. Also, genotypic differences were observed across locations and years for total tuberous root number, fresh cassava tuberous root yield and harvest index. This study revealed that cassava yield is higher at dryland than wetland zones. These identified genotypes (TMS 30572 and TMS 82/0058) that were outstanding in their performance for the trait measured under wetland or dryland can be made available to farmers in these zones. Also, this result showed that similar genotypes performed better either in wetland or dryland zones. In screening programmes, cassava genotypes, aimed at dryland may be useful in wetland zones.

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