Advances in Biological Research 3 (1-2): 40-42, 2009
ISSN 1992-0067

Effect of Variety, Rhizome and Seed Bed Types on Yield of Turmeric (*Curcuma longa* L) under a Humid Tropical Agro-Ecology

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Abstract: Turmeric (*Curcuma longa* Linn) is one of the minor root crops currently receiving research attention in Nigeria but there is lack of information on agronomic practices for production. A field experiment was therefore conducted at the Research Farm of the National Root Crops Research Institute Umudike in 2004 and 2005 to determine the effects of variety, seed bed and rhizome types on yield performance. The treatments comprised 2 varieties of turmeric [vars. NCL1 and NCL2], 3 rhizome types [whole mother rhizome, primary rhizome and secondary rhizome] and 2 seed bed types [planting on ridge and flat]. The result obtained indicated that turmeric variety was only significant on mother rhizome number but not rhizome yield and other yield parameters in the two years. While the seed bed type and interaction effects were not significant on rhizome yield and yield parameters in both years; the rhizome type significantly influenced the rhizome yield and all yield parameters except the rhizome numbers and secondary rhizome yield that were not significantly affected in 2004. Mother rhizome gave the best performance for all yield and yield parameters in both years followed by primary and secondary rhizomes. It was concluded that turmeric can be planted using mother rhizomes preferably on flat beds after the land must have been ploughed and harrowed.

Key words: Turmeric · Variety · Rhizome type · Seedbed · Yield · Tropical · Agro-ecology

INTRODUCTION

Turmeric (*Curcuma longa* L.) like Ginger belongs to the Family *Zingiberaceae*. Turmeric is valued for its underground orange coloured rhizome which is used as natural colouring agent for food, cosmetics and dye. Curcuminoids the active principles in turmeric rhizomes is known to have some medicinal properties and has been used efficiently in the treatment of circulatory problems, liver diseases, dermatological disorders and blood purification [1-4]. Apart from the rhizome's richness in curcuminoid pigments (6%) and essential oils (5%), it also contains 69.43% carbohydrate, 6.30% protein, 3.50% mineral and other important element on dry weight basis [5,6]. The Turmeric powder is highly valued as base material for curry production in confectionery industries for food seasoning and in the international market especially in US, UK and Middle East as a functional food due to its health promoting properties.

India is the largest producer of turmeric supplying 94% of the world's demand [7]. It is cultivated on a commercial scale and exported as dried rhizomes which are later prepared into different forms to meet diverse end uses. Turmeric can be grown under diverse tropical conditions with altitudes ranging from sea level to 1500m above sea level [8]. It requires a well drained sandy or clay loam soil and temperature ranging between 20-30°C with annual rainfall of 1500 mm or more. In view of the prevailing favourable soil and climatic conditions in Nigeria, the country can play a leading role in turmeric production. Albeit, this potential has not been fully harnessed as the production techniques required are poorly understood hence production have been restricted to homestead gardens [6].

Turmeric is propagated vegetatively through the rhizome. But unlike other root and tuber crops in which the seed type and seed bed requirements for optimum performance are well understood, this information is lacking with respect to turmeric production in Nigeria. Further, reports obtained by several workers from other areas like India, Bangladesh, Brazil, Thailand, Pakistan and Mauritus are rather conflicting and inconclusive. While some workers obtained optimum yield from the use of mother rhizome as planting material [9-11] others either reported optimum crop yield from finger rhizome [12,13] or no significant yield difference in the type of seed materials used [14].

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Table 1: Effects of variety, rhizome and seed bed types on Turmeric performance at Umudike in 2004

Treatments	Total rhizome yield (kg/ha)	Mother rhizome yield (kg/ha)	Primary rhizome yield (kg/ha)	Secondary rhizome yield (kg/ha)	Total rhizome No./ha (x 10^3)	Mother rhizome No./ha (x10^3)	Primary rhizome No./ha (x10^3)	Secondary rhizome No./ha (x10^3)
Cultivar								
IITA	1426.0	333.3	713.0	380.0	330.4	30.2	128.5	171.7
NVRI	1606.0	486.0	620.0	500.0	446.2	48.0	136.5	261.7
S.E.D	NS	NS	NS	NS	NS	22.7	NS	NS
Seed bed type								
Flat (F)	1519.0	440.0	630.0	449.0	361.7	42.0	116.5	203.3
Ridge (R)	1514.0	380.0	704.0	431.0	413.3	36.3	149.8	228.3
S.E.D	NS	NS	NS	NS	NS	NS	NS	NS
Rhizome type								
Mother (M)	2014.0	597.0	799.0	618.0	471.7	50.2	139.0	283.3
Primary (P)	1299.0	299.0	639.0	361.0	361.7	32.3	133.8	196.7
Secondary (S)	1236.0	333.0	563.0	340.0	330.0	34.8	124.5	170.0
S.E.D	36.4	77.7	88.1	NS	NS	NS	NS	NS

Note: NS = Not significant at 5% alpha level

Table 2: Effects of variety, rhizome and seed bed type on Turmeric performance at Umudike in 2005

Treatments	Total rhizome yield (kg/ha)	Mother rhizome yield (kg/ha)	Primary rhizome yield (kg/ha)	Secondary rhizome yield (kg/ha)	Total rhizome No./ha (x 10^3)	Mother rhizome No./ha (x10^3)	Primary rhizome No./ha (x10^3)	Secondary rhizome No./ha (x10^3)
Cultivar								
IITA	1847	706	799	434	430.1	57.9	134.3	237.9
NVRI	1574	586	545	524	415.8	51.7	110.1	254.0
S.E.D	NS	NS	NS	NS	NS	NS	NS	NS
Seed bed type								
Flat (F)	1927	731	740	456	440.8	56.5	129.9	254.4
Ridge (R)	1494	559	604	493	414.0	53.1	114.4	246.5
S.E.D	NS	NS	NS	NS	NS	NS	NS	NS
Rhizome type								
Mother (M)	2849	1016	1042	688	655.5	76.9	187.9	390.7
Primary (P)	1803	632	663	417	414.4	58.1	129.9	226.4
Secondary (S)	479	286	313	333	198.8	29.2	48.81	120.8
S.E.D	472.4	175.5	185.3	116.2	68.6	9.89	22.6	50.7

Note: NS = Not significant at 5% alpha level

It is known that improvement of crop cultivation technology for local climatic and edaphic factors is imperative for successful crop production. Hence, this experiment was set up to ascertain the effects of different rhizome types and seed bed preparation methods on growth and yield of turmeric under the humid tropical rainforest belt of southeastern Nigeria.

MATERIALS AND METHODS

The field experiment was carried out at the Experimental Farms of the National Root Crops Research Institute, Umudike Nigeria (Longitude 07° 33'E, Latitude 05° 29'N, elevation 122 m) during 2004 and 2005 cropping seasons. The rainfall pattern is typically bimodal with the first peak between June and July and second peak around August to September. Both temperature and humidity are normally high throughout the year except in the dry season when the relative humidity is usually low for a period of 3-4 months coinciding with a period of "harmattan". Treatments comprised 2 varieties of turmeric: NVRI (NCL1) and IITA (NCL2); 3 rhizome types: whole mother rhizome, primary rhizome and secondary rhizome along with 2 seed bed types: ridge and flat beds. The experimental design was a split-split plot arrangement with 3 replications. Variety occupied the main plot, Seed bed type - subplot and rhizome type, sub-sub plot. The land was ploughed and harrowed while ridges were prepared only on plots meant for ridging as a treatment. The experimental plot size was 4×4 m (16 m^2) in 2004 but 6×3 m (18 m^2) in 2005 and the plant spacing was 1×0.5 m (20,000 plants/ha). A mixture of Gramozone with Premextra was applied at recommended rate as pre-emergence herbicide at planting and was supported with 2 manual weeding at 8 and 12 weeks after planting (WAP). NPK 15:15:15 was applied at 8 WAP at the rate of 400 kg/ha. Harvesting was carried out at 7 and 8 months after planting (MAP) in 2004 and 2005 respectively. Yield data collected were subjected to Analysis of Variance (ANOVA) and standard error of the difference (SED) calculated.

RESULTS AND DISCUSSION

The response of turmeric to cultivar, seed and seed bed types are presented in Table 1 and 2. Cultivar effect

was only significant on mother rhizome number but not other yield and yield parameters in 2004 and 2005. Seed bed type had no significant effect on rhizome yield and yield parameters in both years similarly the interaction effect was not significant hence data on interaction effect was not presented. Rhizome type significantly influenced total, mother and primary rhizome yields in 2004 but the entire yield and yield parameters were significantly affected by rhizome type in 2005. Mother rhizome gave the best performance for all yield and yield parameters in both years. This is in agreement with the findings of [15, 9, 10, 11] but at variance to the reports by [12, 13]. The former workers have also reported mother rhizome as suitable planting material for turmeric in Thailand, India and Bangladesh respectively; although no report was made on the best seed bed type for turmeric production. That seed bed type did not significantly affect yield of turmeric in this experiment implied that turmeric can be successfully cultivated on flat preferably after the land has been ploughed and harrowed or perhaps where the soil is loose and well drained. However, that the mother rhizome gave the best performance could be explained in terms of sufficient food reserves which probably encouraged vigorous plant growth and eventually translate into yield. The implication of this is that the mother rhizome can be used as planting material while other rhizome types (primary and secondary) can be processed into different end uses.

CONCLUSIONS

From the result, it can be concluded that any of the two varieties of turmeric used in this experiment will suffice to produce good yield. In addition, planting either on the flat or ridge using the mother rhizome will ensure optimum growth and rhizome yield. However, for optimum yield to be obtained when planting on the flat, the land has to be ploughed and harrowed for good rhizome formation.

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