# A REVIEW OF FACTORS THAT INFLUENCE THE GROWTH AND YIELD OF SWEET POTATO UNDER FIELD CONDITION

***By***

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***Abstract***

*Crop production under field conditions is the goal in most agricultural experiments. The factors that influence the growth and yield of sweet potato under field conditions were reviewed in this paper. Understanding of these factors is very foundational and critical to the enhancement of the yield of the crop. There are factors that are inherent to the crop, while others are external, all of which are subject to scientific engineering and cultural manipulation to increase tuber yield. Soil conditions are significant to the growth and yield and there is the need for a prior determination of the nutrient status of the soil before planting is done. The site of production too needs to be in the ecological zone to which the crop is naturally adapted. The need to enhance the factors that promote tuber yield is emphasized, while placement method for less soluble fertilizers, provision of vine supports or stakes, increasing source and sink capacities, good pests and disease management, wider use of sweet potato, bridging the gap between the crop and tuber crops as well as improved post-harvest management are advocated.*

## INTRODUCTION

In experimental agriculture, crops can be grown in the green house under which the growth conditions are well controlled. The performance of crops under such a condition is never the same with what obtains under field conditions. In the field, crops are exposed to the hazard of edaphic or soil factors as well as unpredictable climatic conditions. Therefore, a review of the factors that affect the growth and yield of sweet potato under field conditions is not out of place. Sweet potato *Ipomoea batatas* (L.)Lam) belongs to the family Convulaceae and it is a crop that is widely grown in many parts of the tropical and sub-tropical regions. It grows best on sandy loam soils with good drainage and a pH range of 5.6-6.6. Rainfall of 75-100cm per annum and temperatures above 24$^0$C are considered adequate for the crop, Cobley, (1976). Each plant produces only a few number of tubers and as plant population per hectare increases, the number of tubers per plant decreases; the mean weight per tuber decreases, and the yield per plant also decreases (Enyi; 1977).

Sweet potato is a high energy producing crop and it is one of the most promising food crops that can meet the energy requirement of the people in the tropics. Apart from its importance as human food, sweet potato provides animal feed and raw materials for industries. It requires relatively little attention and its production costs are low compared with some other field crops. It has very high-solar energy fixing efficiency among food crops, because of its tremendous capacity to produce dry mater (DM) for a long period of time.

In Nigeria, sweet potato is comparatively not as popular as other root and tuber crops like cassava, cocoyam and yam. Yet in some localities; it is a cultural crop in the sense that, it is deeply associated with the culture of the people that consume it in different forms. Haynes and Wholey (1971), observed that the number of tubers per plant can range from 0-13 and the weight of tubers per plant, can range from 10-872g. These investigators attributed the variation in the number and yield of tubers to factors external to the crop such as soil, management practices, climatic conditions, as well as inherent factors; including type of planting material. Furthermore, Haynes (1970), was able to identify some general and regional problems of sweet potato production. Among the general problems are the use of inappropriate planting materials in particular production systems and in the high degrees of variability of the sweet potato crop itself. The regional problems according to Haynes, are related to environmental conditions, the level of technology under which the crop is grown and the agronomic practices incorporated into the production system.

Sweet potato characteristically is a heavy utilizer of soil nutrients in the light of its morphology, especially the elaborate foliage cover that is a consequence of its creeping vines. Adventitious roots develop at the nodes and the tendency of tuberization at the upper nodes is equally high. The effects of Nitrogen (N) and Potassium (K) on the growth and yield of sweet potato have been a major field of interest to many investigators. Duncan, Scott and Stark (1958), and Godfrey-Sam-Aggrey (1974), concluded that, fertilizers containing higher K rates and an N/K ratio of 3:4 gave maximum tuber yields. Generally, it is known that the response of sweet potato to fertilizer application depends on the soil type, the environment and the cultivar grown. In addition, it is known that Phosphorus (P) improves the water use efficiency (WUE) of crops and plays a principal role in energy transfer and storage as a constituent of Nicotinamide Adenosine Dinucleotide Phosphate (NADP) as well as Adenosine Triphosphate (ATP); Tisdale and Nelson, (1975), Tombesi, Cale and Tiborne (1969), Rendle and Kang, (1977). Sweet potato is a high energy producing crop and still, its response to added phosphate fertilizer has not been very consistent which may as well be the factor of native soil P. Rendle and Kang (1977), reported that P response of sweet potato has been observed to be small or outrightly insignificant. In their pot experiment, they could not obtain a decisive response of sweet potato to added P. Even at this, the conditions of pot experiment are different from what is obtained under field conditions. Similarly, Constantin, Jones and Hernandez (1977), reported that considerable research has been directed towards the effects of K and P fertilization on the yield, shape, grade and vine growth of sweet potatoes. However, some controversy exists as to the response of sweet potato to P fertilization; probably due to the effects of inherent soil P. Thus, different factors profoundly influence the growth, development and yield of sweet potato under field conditions. Enhancement of these factors, when so identified will go a long way to promote the tuber yield (both in quality and quantity) of sweet potato.

## GENERAL REVIEW

The crop plant is a biological system that is influenced negatively or positively by a number of internal as well as external factors. The preponderance of those factors that enhance the balanced growth and development of any crop is the major focus in agronomy. When they are naturally present; they are to be maintained and where not; they have to be supplied.

One of the fundamental factors that affect the growth and the yield of sweet potato is the level of **Native Soil Nutrients** (NSN). Those that affect the performance of sweet potato as a crop, fall into the categories of major and minor nutrients. It is a well known fact that, potassium (K) affects tuberous root yield most. It affects the dry matter (DM) production by increasing net Photosynthetic activity of a given leaf area (LA). The concept of native soil nutrients bothers on what a land has through natural processes of nitrification, nitrogen fixation, decomposition, mineralization and nutrient recycling. An uninterrupted land has a stable ecosystem, in which the soil medium and nutrients are at an equilibrium, until such a time of deforestation that agricultural activities entail. A fertile and productive soil therefore will encourage good growth and yield of sweet potato. Root and tuber crops are at home in such Nigerian ecological areas as the forest zone and to some extent the guinea savanna zone, because of the crop growth promoting levels of the native soil nutrients.

**Plant structure** is another pertinent factor influencing the field performance of sweet potato. Plant structure has to do with the morphological arrangement of the various components of the shoot system. The leaves as the principal organ of photosynthetic activities may be fully or partially exposed to absorb sunlight energy, that can be converted to assimilates. Sweet potato crop has a high photosynthetic capacity per unit of leaf area (LA) but mutual shading occurs, because of a leaf arrangement which causes poor sunlight penetration. Consequently, the net assimilation rate (NAR) decreases with an increase of leaf area index (LAI) in natural populations; Ramanujam and Indira, (1979); Lowe and Wilson, (1975), Enyi (1977). Thus Hahn (1977), expressed that, the favourable external conditions for high yield are those which promote nutrient absorption, improve light penetration in natural populations, increase net photosynthetic activity and improved formation and enlargement of tuberous roots.