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# THE PHYSIOLOGICAL RESPONSE OF CASSAVA TO STRESS

*(La réponse physiologique du Manioc au stress)*

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## SUMMARY

Cassava has gained the reputation as a crop that is highly tolerant of the stress conditions found in marginal areas for agriculture.

This paper reviews the physiological basis of this tolerance. Cassava has a long growth cycle and an indeterminate growth habit. Thus short periods of stress have little effect on the overall growth. In addition it has no critical growth periods such as flowering when short stress periods affect critical processes in yield formation. Cassava simultaneously develops its source, leaves, and its sink, roots. During stress periods the balance between source formation and sink filling is shifted towards the roots. Thus although total biomass production may be reduced markedly in stress periods the effect on root production is less marked. At low fertility levels leaf area index is reduced, but the nutrient content of leaves is maintained allowing for efficient photosynthesis. Similarily under drought conditions leaf area index is reduced, resulting in reduced water loss. This effect coupled with a stomatal reaction to changes in relative humidity of the ambient air allows cassava to survive long dry periods and use limited water very efficiently.

## RESUME

*Le manioc a la réputation d'être une culture très tolérante aux conditions de stress des zones agricoles marginales. Cet article passe en revue les bases physiologiques de cette tolérance. Le manioc a un long cycle de développement et une croissance de type indéterminé. Aussi de courtes périodes de stress n'ont-elles que peu d'effet sur*

*la croissance globale. De plus, le manioc n'a pas de périodes critiques de croissance, telle que la floraison, durant lesquelles de courtes périodes de stress pourraient avoir une grosse influence sur le rendement. Le manioc développe en même temps ses feuilles (organes "source") et ses racines (organes "puits"). Pendant les périodes de stress, l'équilibre "source-puits" est modifié en privilégiant le remplissage des racines au détriment de la formation des feuilles. Aussi, bien que la formation de biomasse soit réduite nettement par les périodes de stress, l'effet est faible sur le rendement en racine. Avec une faible fertilisation, l'indice foliaire est réduit, mais les concentrations foliaires restent suffisantes pour permettre une photosynthèse efficace. De même une alimentation hydrique réduite diminue l'indice foliaire ce qui conduit à une réduction des pertes d'eau. A cela s'ajoute une réaction des stomates aux changements d'humidité relative de l'air ambiant ; ces deux phénomènes permettent au manioc de survivre à de longues périodes de stress hydrique et donc d'utiliser très efficacement l'eau consommée.*

## INTRODUCTION

Cassava has gained the reputation of being a crop that grows particularily well on infertile soils in areas with uncertain rainfall. Furthermore in Africa where locusts are a serious problem it is recognized as extremely tolerant to attack. In this paper the physiological basis of cassava's tolerance of stress is discussed.

The cassava plant, like most root crops, simultaneously produces new leaves (the source of carbohydrates and deposits carbohydrates in the roots. This situation constrasts with the determinate crops in which the reproductive organs are the useful parts. In these crops the source is developed first and then the sink is filled. This particular characteristic of the root crops leads to two fundamental aspects of their physiology. First of all they tend to have an optimal leaf area index for yield and secondly they do not have critical periods when stress over a very short time span can have disastrous effects on yield.

## CASSAVA GROWTH UNDER NON STRESS CONDITIONS

Under good conditions the cassava plant after germination rapidly produces small leaves from the apical meristems. The size of the leaves produced increases with each subsequent leaf until 4-6 months after planting and then declines. The rate of leaf production per apex initially is approximately 5 per week but declines as the plant grows older to about 1 per week. Initially one or more of the axillary buds on the planting piece grow and later when the apex becomes reproductive the development of the axillary buds directly below the reproductive organ gives the branching (forking) characteristic of cassava. The branching habit