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CASSAVA CULTURAL PRACTICES

Proceedings of a workshop held in Salvador, Bahía, Brazil, 18-21 March 1980

Editors:
Edward J. Weber, Julio Cesar Toro M., and Michael Graham

Organized by:
Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA)
Centro Internacional de Agricultura Tropical (CIAT)
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Contents

Cassava Planting Material: Management Practices for Production

Abelardo Castro M.[1]

Good quality planting material is the basis for high root yield. Cassava is a traditional crop that uses few improved cultural production practices and technologies. Research data have identified major biotic and abiotic problems and defined practices that avoid, reduce, or eliminate them. This paper suggests an integrated on-the-farm plot management system for the production of high-quality planting material and high root yields.

Introduction

As the area and intensity of cassava cultivation continues to increase, disease and pest attacks will also increase in their intensity. The common belief that cassava does not suffer from pests and diseases does not hold true any longer because more than a hundred insect and mite species have been recorded and about 30 cassava diseases induced by viruses and virus-like causal agents, mycoplasma, bacteria, and fungi have been reported (Lozano and Booth 1974). Some pests and diseases can induce heavy losses or can even cause complete crop failure, and others do not at present cause economic losses. The recent introduction and consequent outbreak of the mite *Mononychellus tanajoa* in West Africa has caused serious crop losses. Nevertheless, cassava is more tolerant of disease and pest attacks than are many other crops because of a lack of critical periods in yield formation (Cock 1978). Cassava yield must be evaluated according to three criteria: the roots, which are the edible or salable product; the stems, which constitute the propagating material; and the destination of the crop, because if no utilization is provided for the roots or stems there is no reason to cultivate the crop. In this paper the production of good cassava planting material, as it relates to diseases, pests, soil fertility, and general management, is discussed.

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Cassava Cultivation

Cassava, being a traditional crop, is grown according to long-standing practices, although the introduction of new technologies based on existing practices could significantly increase yields. In fact, the results of 5 years of regional trials at eight locations in Colombia conducted by CIAT have shown threefold increments in the yields of local varieties by the use of selected and treated planting material, adequate soil preparation, optimum planting density, and timely weed control (CIAT 1979). Yield can be increased further by the introduction of new disease- and pest-free cultivars if they have been adapted to the ecosystem, and optimum yields can be obtained through the introduction of new hybrids with resistance to the negative production factors of a given ecosystem.

In any vegetatively propagated crop, good planting material (stakes) is necessary for high yields. In cassava, poor sprouting or low-vigour stands may drastically reduce yields and the production of propagation material. Cassava stakes have the ability to sprout even under severe stress conditions, but sprouting does not necessarily imply high root yield. At present, low yields at the farm level are considered to be a characteristic of this crop. Consequently, farmers often underestimate the need for adequate selection of planting material, and this job is performed by labourers who have not received specific training in this aspect. Thus, in most cassava plantations, plant stand is lower than the number of stakes planted originally, and there is high variability in vigour from one plant to another. Although edaphic and climatic factors may account for some losses, the use of high-quality, clean stakes, as described elsewhere (Lozano et al. 1977; Nestel 1976), will generally reduce the relative frequency and intensity of losses. Unfortunately, cassava growers may not be willing to adopt practices that might increase production costs (the stakes would have to be purchased).

Sources of Planting Material

Unlike seeds of grain crops, cassava stakes are not commonly sold, and the farmers usually produce their own planting material. To supply stakes continually to satisfy their planting requirements, they must often introduce stakes from neighbouring regions because the stakes cannot be stored for an extended time. As the need for and interest in introducing or increasing the availability of a cultivar with desirable characteristics expands, farmers, institutions, and governments are increasingly exchanging cassava planting material. Expansion of cassava cultivation, production, and productivity is being threatened by a lack of knowledge or an underestimation of the many disease and pest problems that may be introduced through shipment of vegetative planting material. Lack of quarantine regulations also increases the danger of pest introduction into new regions or countries.

Quality of Planting Material

Both abiotic and biotic factors affect cassava crop production. Abiotic factors are determined by climatic and soil conditions; they set the potential production of the crop. Usually it is not economic to alter these factors, but a knowledge of the prevalent conditions will be useful in managing the crop for optimum yields. The climatic factors are primarily temperature and rainfall. In general, mean annual temperatures below 22 °C imply a growth period of more than 12 months, whereas temperature fluctuations for a 24-h period determine disease incidence. Total rainfall and its distribution also affects disease and pest incidence and, hence, yield potential. In general, two rainy periods alternated with dry seasons reduce pathologic and pest problems. The soil factors limiting cassava productivity are low pH, high aluminum concentration, low fertility, low organic matter content, and textures of either clay or sand.

Biotic factors, both diseases and pests, can limit cassava productivity to various degrees, and the variety of the cassava also reduces yields if not adapted to the environment. In addition, fungi, bacteria, viruses, virus-like and mycoplasma diseases can localize in roots, causing rotting; foliage and green stems, reducing photosynthesis and affecting total plant vigour; and in the propagative material. In this paper we are mostly interested in the diseases and pests that can be found in the stakes (because they affect sprouting or yield when they are used as vegetative reproductive material) and in those that attack planting material while in storage.

Cassava pests and diseases have both been discussed and their control measures recommended elsewhere (Bellotti 1978; Bellotti and van Schoonhoven 1978b; Bock et al. 1976; Lozano 1977, 1978b; Lozano and Booth 1974). Their control must be approached from two different angles. One is through research; the other is through farming practices. Basically, in-depth knowledge is sought on the biology, interrelationships of the problem with the crop, bases for biological control, rate of spread of the causal agents, vector efficiency, crop loss, identification of resistance genes, and the creation, through breeding, of tolerant or resistant cultivars. However, this is a long-term process. In the meantime, with the knowledge available, farmers have at their disposal technological and cultural practices (Castro 1979) that control, reduce, or possibly eliminate the problem from a field. When applied, these practices have been shown to increase yields immediately.

On-the-Farm Plot Management

Research efforts and findings must be channeled into extension activities so that they reach farmers and ensure good planting material. The first responsibility of researchers is to define the status of cassava diseases as completely as possible on a regional or country level. They can gain some insights from past workshops and symposiums on diseases, causal agents and vectors (Brekelbaum et al. 1978; IITA 1972; Maraite and Meyer 1979; Pires de Mattos et al. 1979). It is known, for example, that African mosaic disease (AMD) and brown streak virus (BSV) are restricted to Africa and probably India, as common mosaic virus disease (CMVD), leaf vein mosaic (LVM), and latent viruses (LV) are restricted to tropical America (Lozano 1978b). If one considers distribution, incidence, and losses, AMD is the most important disease of cassava because it can cause losses of more than 50% or as little as only 2% (Bock and Guthrie 1978), depending on the conditions for control of the whitefly vector (*Bemisia* spp.). The low rate of spread of mosaic into mosaic-free plots (2% in 14 months) and also within plots (13%) indicates that whiteflies are comparatively inefficient vectors and that man is the principal vector in his indiscriminate use of infected stakes as propagation material (Bock and Guthrie 1978); indeed he is also the only known vector of the CMVD in the Americas. Consequently, these diseases can be controlled easily by the use of healthy planting material (Costa 1971). Once the presence of the disease is determined in a region or country, clean-up can be achieved by meristem culture carried out by the national agencies, as described elsewhere (Kartha and Gamborg 1979), and production of disease-free material can be done in multiplication units outside the infected area. A second responsibility of researchers in conjunction with extensionists is to develop field diagnosis techniques that can be translated into educational programs for cassava growers, who need to become fully aware of the economic importance of the disease. This will be mainly an extension education responsibility. Only when farmers achieve a certain level of agricultural education, will they be willing to apply the recommended control measures: roguing diseased plants, obtaining disease-free stakes from local institutions, and planting them — whether they be local or introduced cultivars — in isolated plots to increase the amount of clean planting material. In other words, a prerequisite is that the farmers believe in the benefit of what they are doing.

The following recommendations, if implemented, will help to keep cassava crops disease- and pest-free and will provide more and better planting material.

(1) Plot location. The multiplication plot should be in an isolated but accessible area of the farm because continuous inspections of the crop should be carried out. Whenever possible, fertile, medium-textured, and well-drained soils should be selected. If drainage is poor, it must be improved before planting. If rainfall is higher than 1200 mm a year, planting on ridges is recommended. The plot should be located close to irrigation ditches that can supplement deficient rainfall. The cropping history of the plot must be known, and, if possible, either the most recent crop should have been Gramineae or the plot should have been left fallow to break biological cycles of pests and diseases.

(2) Soil preparation. The plot should be deeply plowed, disked, and ridged, if necessary, and the improvement of drainage and irrigation facilities should be considered. Soil chemical analyses must be made and fertilizer applied accordingly. Fertilization of cassava may not always increase root yields, but it does increase aboveground growth as measured by harvest index (CIAT 1979). Recent research data (R. Howeler, CIAT, personal communication) and field observations indicate that root yields are higher from stakes originating from well-fertilized soils than from those coming from low-fertility soils. In relation to diseases, NPK fertilization of cassava induces resistance to cassava bacterial blight (Arene and Odurukwe 1978). Further studies are recommended so that induced resistance to other diseases and pests can be evaluated.

(3) Varietal selection. Farmers have a choice when multiplying a cultivar: they can clean their own traditional cultivar or they can multiply one that is introduced. To choose the best alternative, they should consult with extension agents in conjunction with researchers to ensure the new cultivar has been adapted to the local ecosystem.

(a) Adapted cultivars are those that produce stable yields throughout the years. A cultivar not adapted to the ecosystem will yield few or no stakes and root yield will be low.

(b) The multiclonal system consists of the mixed planting of several cultivars and is a system frequently used by traditional, small cassava growers. The basic principle is based on the different degrees of tolerance and resistance to various pest and disease problems, such that the rate of spread of the causal agent of the problem is delayed when moving from one plant to another from a different cultivar. The use of this system on a commercial level is something yet to be studied. Basically, the agronomic characteristics of the multiclonal system must be similar, but they must differ in their resistance or tolerance to the various pest and disease problems.

(4) Spatial arrangement. Results indicate that there is an optimum planting density for different cultivars in different ecosystems (CIAT 1979) and also that a square or rectangular planting pattern does not significantly affect root yields if optimum planting density is used.

Strip-cropping research being carried out at present by CIAT and double-row cropping as reported by Pires de Mattos et al. (1979) may be suggested for optimal aboveground growth. The uncultivated strips allow for easier and more efficient visual inspections of the field; for the application of chemicals, protectants, and fertilization; and also for the ease of management of the harvested stakes within the cultivated strips. Planting density may be altered according to plant type so that stake number and root yield are optimized.

(5) Postcultivation management of the plot. Cultivators must give emphasis to inspecting fields periodically; roguing and burning diseased plants; and controlling weeds to have vigorous cassava plants. If possible, the field should be supplemented with irrigation when rainfall is deficient. There are several pests that feed on stems and leaves (*Erinnyis ello*, *Atta* sp., *Acromyrmex* sp., *Zonocerus* sp., *Vaginulus plebeius*) for which there is no source of varietal resistance (the field must be kept under visual inspection and sprayed with protective insecticides or attractants applied as soon as any of these pests appear). Insecticides like Aldrin and Carbofuran should be applied to the soil and around the planted stake to control attacks of larvae of Scarabaeidae, Cerambycidae, and *Coptotermes*, which attack the stakes and cause the death of young plants.

Stake Selection and Handling

The basic considerations for stake selection and handling are described elsewhere (Lozano and Terry 1977; Lozano et al. 1977). The most important factor is the visual selection of stems from apparently healthy plants. The plantation should not be left after the crop reaches maturity because buds lose their viability, the stems become too lignified, decreasing sprouting, and the presence of undetected pests and diseases is more likely.

The machinery, machetes, equipment, and labourers should be carefully disinfected before entering a new field, and the machetes should be disinfected with detergent and water between plants. The discarded vegetative material must be removed from the plot and burned to avoid substratum for pest and disease development. The handling of either short stakes or stems should be done as carefully as possible so that they are not damaged. For the same reason, it is recommended that cardboard or wooden boxes be used during transport and storage. Stake treatment is recommended by Lozano et al. (1977) for the production of planting material. If storage of more than a week is required before planting, chemical treatment is a must.

Storage of Planting Material

Much more research is needed on the storage of planting material, as the material often has to be stored for extended periods (up to 5 months) due to flooding, drought, or cold weather. During flooded conditions, the stakes are stored in floating houses, and in cold places where frost occurs, they have to be kept in a vertical position in trench silos. Large plantations cannot use such methods because of their large volumes. Research in progress at CIAT (1980) suggests that 1-m stems, treated with BCM and Captan (Bavistin and Orthocide) at 3000 ppm each before storage, given the standard dip treatment, and stored up to 90 days in shady open-air conditions, can produce a stand of about 95% of what can be produced at harvest by freshly cut stakes, but root yield is reduced by 32% (see Fig. 1, page 36). Further studies under flooded, drier, and colder climatic conditions are needed.

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