CIAT
1923
COLECCION HISTORICA

MICROFILMADO

NATURAL DRYING OF CASSAVA

by

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ABSTRACT

There is a trend towards using natural dried cassava as an animal feed. However, the technology of cassava drying is not well developed. The rate at which cassava dries when placed in the open air depends on the drying system, the relative humidity, the air temperature, and the wind velocity. Particles in the form of rectangular bars (0.8x0.8x5.0 cm) dry much more rapidly than standard sliced chips. The drying rate can further be increased by placing the bars in horizontal, or better, vertical wire mesh trays. These drying systems utilize more efficiently the available energy of the air to evaporate the water.

RESUMEN

Aunque la tecnología del secamiento natural de la yuca no ha sido bien desarrollada, existe una tendencia a utilizar yuca seca para la alimentación animal. Las ratas de secamiento de la yuca cuando se expone al aire libre depende del sistema de secamiento, la humedad relativa, la temperatura del aire, y la velocidad del viento. La yuca cortada en forma de barras rectangulares (0.8x0.8x5.0) seca más rapido que la cortada en forma de rebanadas convencionales. La velocidad de secamiento puede incrementarse exponiendo las particulas de yuca horizontalmente, o mejor, verticalmente en bandejas de anjeo. Estos sistemas de secado utilizan mas eficientemente la energía disponible del aire para evaporar el agua.

BIBLIOTECA

INTRODUCTION

The fresh cassava root is a highly perishable commodity that begins to show signs of deterioration within 2 to 3 days of harvest if it is not suitably treated and stored. Traditionally, cassava in dried after processing (as Farinha in Brasil or Gari in Nigeria) but now there is a recent trend towards drying cassava directly, using it then as a source of cheap energy in animal feeds. In Thailand, more than 95% of the total production of cassava is processed by direct solar drying.

A simple engine driven chipper that produces rather flat irregular shaped chips of cassava is commonly used, the chips then being placed on concrete to be dried. We at CIAT felt that with simple technology these drying methods could be greatly improved.

Attention needs to be given to increasing the rate of drying. It may be thought that more extensive, less rapid drying systems, would be effective. This is not so because cassava chips, unless they reach 50% moisture content, wet basis, in the first day, will deteriorate rapidly in quality. For storage the moisture content finally achieved must be close to 14% moisture content.

METHOD

Cassava particles of various geometrical forms were dried under different measured ambient conditions and their rate of drying determined. A complex simulation model was designed and with this model 98% of the variation in drying rates was accounted for by the (1) a set of constants for the drying system being used, (2) variations in relative humidity, (3) variations in wind speed, and (4) variations in temperature. A complete description is given by Roa(1974). Figure 1 shows the close correlation between actual and simulated moisture contents.

The model simulations are used in this paper to describe the improvements that may be made in present drying methods by changing particle form and sizes and drying systems under different conditions. The use of average ambient conditions of the effective drying hours of a day can be used to predict average drying rates with accuracy.

RESULTS AND DISCUSSION

Because cassava particles are white and have a very high reflectivity they do not absorb incoming solar radiation efficiently.The air drying rate is therefore almost completely independent of the direct effects of solar radiation.

Cassava chips dry rapidly when there is a rapid movement of warm dry air through the mass of chips. The energy required for evaporation is supplied by the availabe energy of the air. Therefore, efforts to improve cassava drying systems where air of ambient relative humidity and temperature is used should concentrate on increasing air movement through the mass of chips.

In most of the commonly used drying systems, cassava is placed directly on a concrete pad. The wind speed at or near the ground surface is very low and air movement through the cassava would be expected to be low. Cassava particles in trays raised 30-cm above the ground level dried much more rapidly than those on the ground, because of increased air movement (Figure 2). Placing the cassava chips in vertical trays, which "catch" more of the wind increased drying rate still further.

To take advantage of such movement, the chips being dried need to permit air passage. Rectangular bars of cassava have better aerodynamical properties than conventional sliced chips. A comparison of their drying rates using simulation shows that they are superior if the bar's section is less than 1.2x1.2 cm (Figure 3), and particularily at high densities of particles per unit area. Using a simple disc chipper that produced irregular rectangular bars (disc bars) drying rate was better than with the conventional chips.

The most rapid simple drying system, so far obtained has a chip form with small section and high porosity (eg 0.8x0.8x1.0 to 5.0 cm bars) placed in vertical trays. The rate of drying with this system is more than double that of the conventional system.

The maximum permisable density which will allow cassava to reach 50% moisture content, wet basis, in the first day, can be calculated for different drying conditions if the average temperature, humidity, and wind speed for the effective drying hours of a day are known. The water vapor pressure deficit is obtained form Figure ~~2~~4-a and hence, the layer density from Figure ~~3~~4-b. These graphs are applicable only to the vertical drier using disc bars, however, further curves can be constructed for any system of drying. Layer densities calculated with these curves would take about three days to reach a moisture content close to the equilibrium moisture value given by the weather conditions. (Figure 5).

In order to store cassava without deterioration, it must be dried to 14% moisture content, wet basis. Using air at ambient temperature and moisture conditions cassava can only be dried to its equilibrium moisture content. When relative humidity does not drop to about 75% it is necessary to use suplemental heat to dry cassava to a safe storage level.

Cassava is normally grown for periods of 10 months to 24 months, hence harvesting on the exact date planned is not vital. Thus, cassava can be harvested in the dry season, or when conditions are suitable.

The construction of vertical trays to hold cassava would be costly and they would be difficult to fill. The use of horizontal trays, or inclined wire mesh trays, appears to be quite feasible and should give much more rapid drying than present methods.

The construction of a cheap chipper that produces chips of the required geometry needs to be further researched. However, there is little doubt that more rapid drying can be achieved by using a square rectangular bar of about 0.8x0.8x(0.8 to 5.0) cm.

ACKNOWLEDGEMENTS

We are grateful to Dr. Loyd Johnson for his ideas and technical help in developing this project and later in reviewing this paper, Dr. Fred W. Bakker-Arkema, the senior author major professor, the Rockefeller Foundation for their financial support of the senior author as a graduate student, and the International Development Research Centre, IDRC for providing funds for the presentation of this paper.

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Roa, G. (1974) Natural Drying of Cassava. Unpublished Ph.D. thesis. Agricultural Engineering Department. Michigan State University. East Lansing, Michigan.

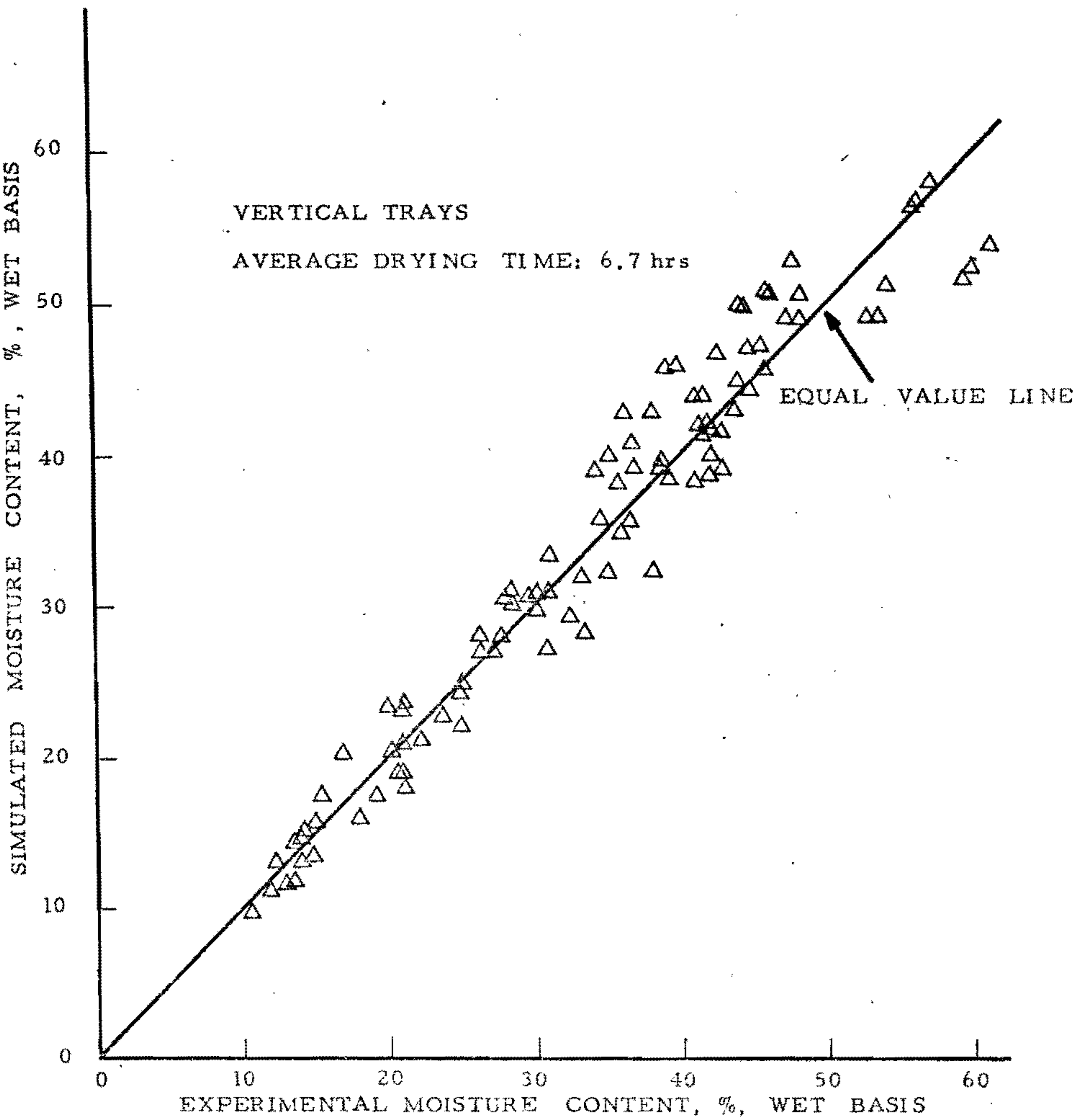

FIGURE 1. COMPARISON OF EXPERIMENTAL AND SIMULATED MOISTURE CONTENT VALUES AT THE END OF A DRYING DAY

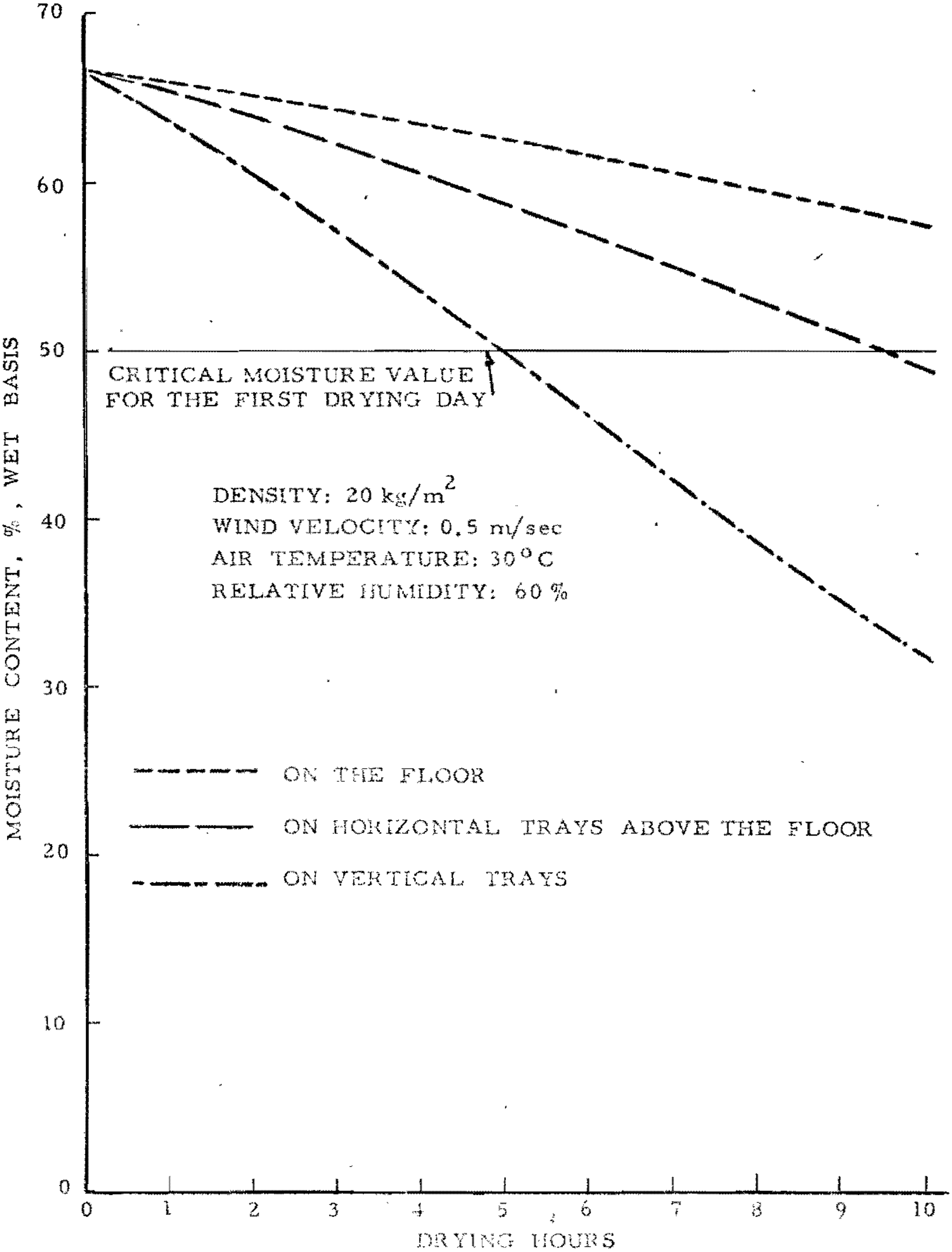

FIGURE 2. DRYING CURVES AS A FUNCTION OF DIFFERENT DRYING SYSTEMS USING BARS 0.9x0.9x5.0 cm. (SIMULATED)

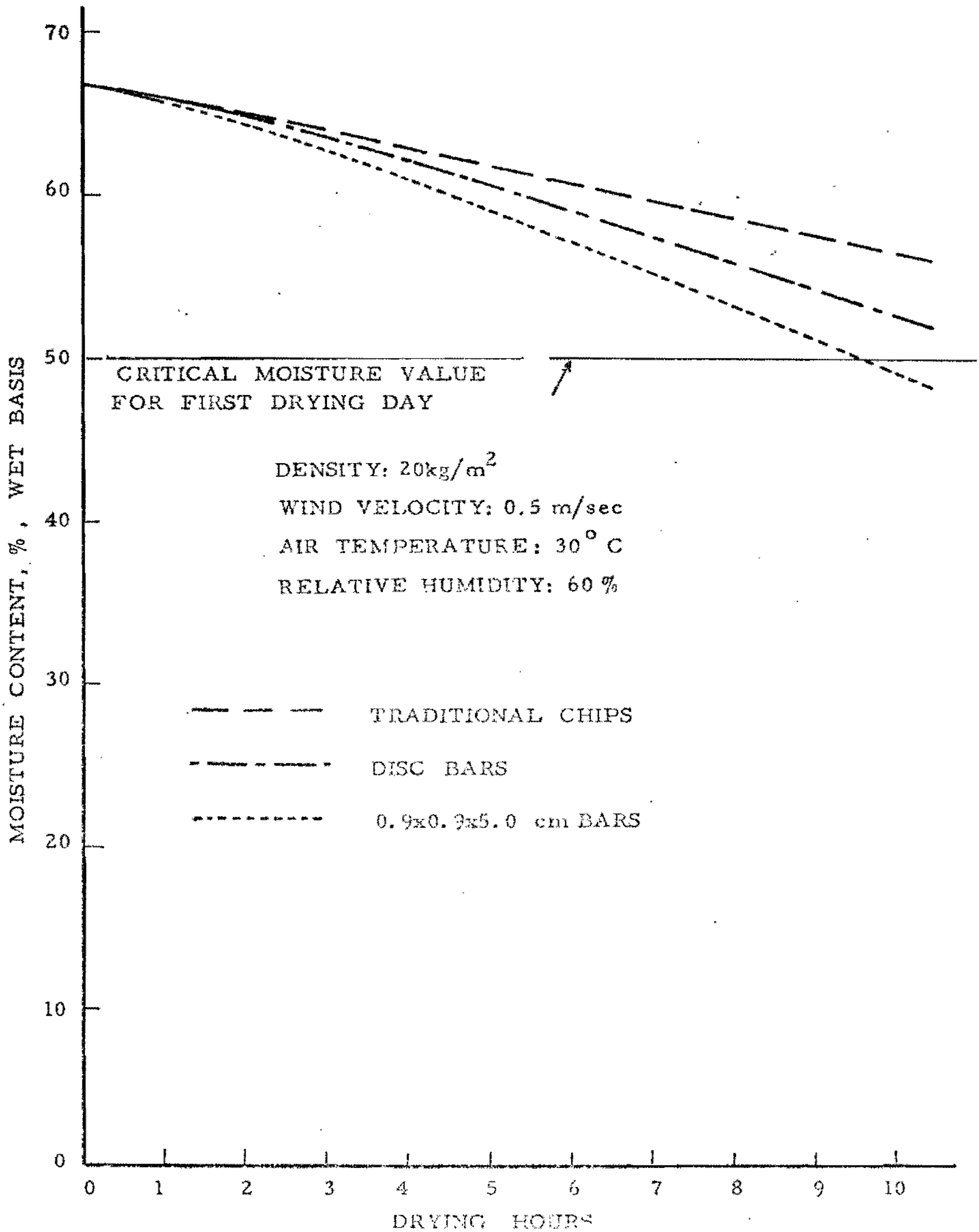

FIGURE 3. DRYING CURVES OF DIFFERENT TYPES OF PARTICLES USING HORIZONTAL TRAYS AT 30 CM ABOVE THE FLOOR. (SIMULATED)

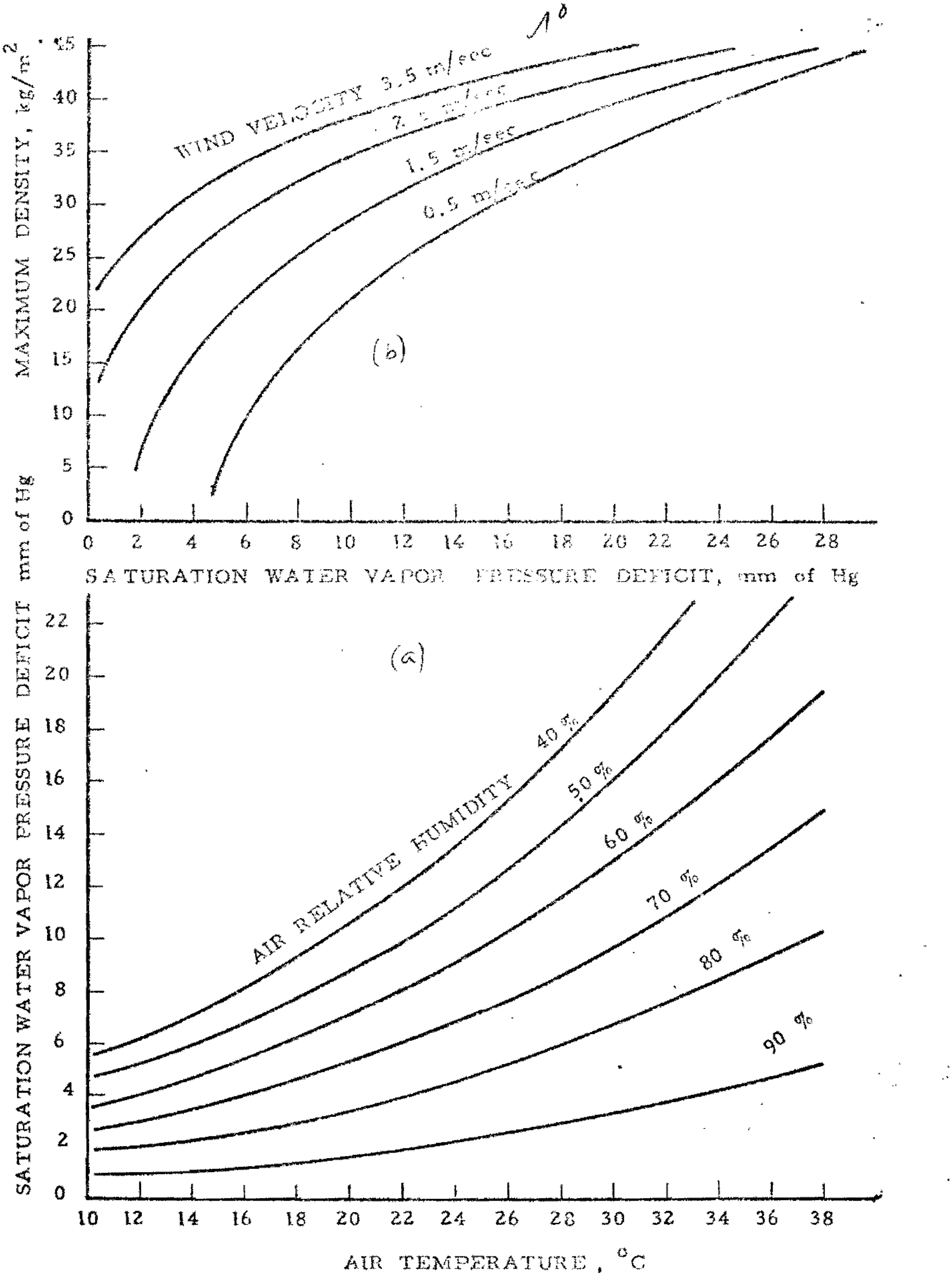

FIGURE 4. MAXIMUM DENSITY PERMISSIBLE UNDER DIFFERENT WEATHER CONDITIONS FOR USE WITH VERTICAL DRIER USING DISC BARS. TIME: 11 HRS.

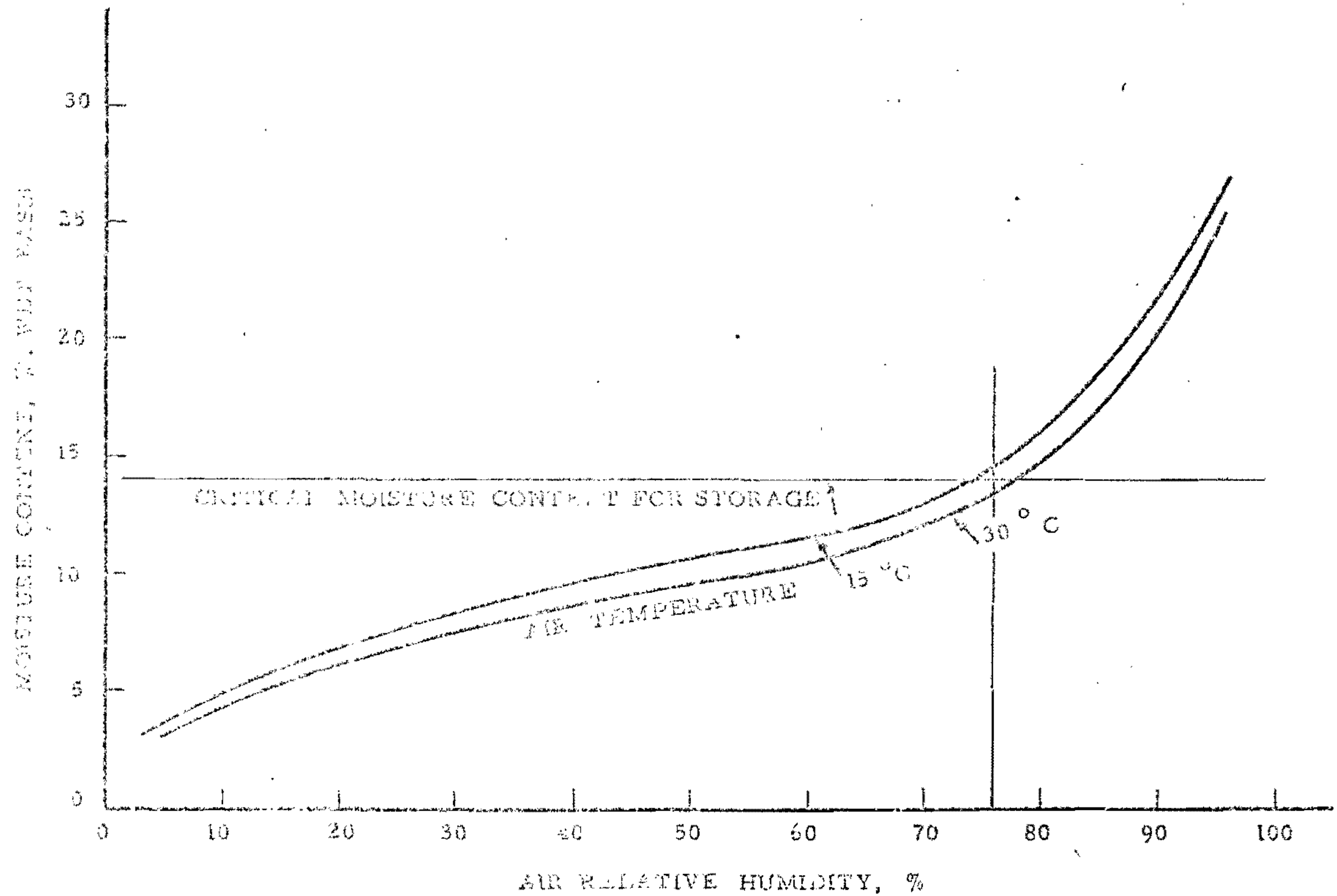

FIGURE 5. EQUILIBRIUM MOISTURE CONTENT CURVES OF CASSAVA