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CURRENT SITUATION OF CASSAVA IN VIETNAM AND THE SELECTION OF CASSAVA DOUBLED HAPLOID (DH) LINES DERIVED FROM CIAT

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INTRODUCTION

Cassava (*Manihot esculenta* Crantz) in Vietnam has been rapidly changed its role from food crop to industrial one in the beginning of 21st Century. Vietnam is now the second largest exporting country of cassava products after Thailand while animal feed factories also contribute significantly to the increasing demand for cassava root. Vietnam has recently developed an E10 policy requiring the production of 100 to 150 million liters of bio-ethanol from cassava per year (Hoang Kim *et al.* 2008). Vietnam has made the fastest progress in application of new technologies in breeding and new cultivar propagation in Asia, (Kazuo Kawano 2001). Such progress has been considered as a result of many factors, of which the success in breeding and application of new technologies were the main contributing factors (Hoang Kim et al. 2007).

This paper cover in: 1) Current situation of cassava production and consumption in Vietnam, 2) The selection of cassava doubled haploid (DH) lines derived from CIAT. 3) Lessons learned from the Vietnam Cassava Program and the potential of cassava as a bio - fuel feedstock for increasing demand of cassava

1. CURRENT SITUATION OF CASSAVA PRODUCTION AND CONSUMPTION IN VIETNAM

1.1 Review of cassava production in Vietnam

Cassava in Vietnam is among the four most important food crops (**Table 1**). But it has always been considered a secondary crop even though it has played an important role in national food security.

Cassava production in Vietnam has mainly been allocated in the Central and Southeast with an increase in planted areas in 2001-2006 (see **Figure 4**). In 2006, area planted to cassava was 475,000 hectares, with total production of 7.71 million tons of fresh root and average yield of 16.25 tons per hectare (FAO, 2008). As compared to the year 2000, the production increased threefold; fresh root yield augmented twofold with increasing rate of 14.7% annually (**Figure 5**)

New high-yielding cassava varieties (**Table 4**) and more sustainable production practices have increased the economic effectiveness of cassava production. In year 2006/07 about 350,000 ha of new varieties, mainly KM94, KM140, KM98-5, KM98-1, SM937-26, KM98-7 were grown, this corresponds to about 75 % of the total cassava area in whole country.

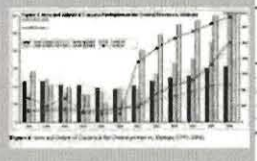
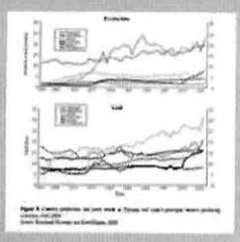


Table 4. New high-yielding cassava varieties in Vietnam (1998-2008) a/

Variety	Growing period (months)	Fresh root yield (t/ha)	Starch content (%)	Starch yield (t/ha)	Harvest index (%)	Plant type & stake quality (1-10)	Root shape & uniformity (1-10)
KM140	9-10	35.0	28.7	10.0	65	10	9
KM98-5	8-10	34.5	28.5	9.8	63	9	9
KM94-1	8-10	32.2	29.6	8.9	66	8	9
KM94	9-11	33.0	28.7	9.5	58	8	8
HL23	9-11	16.5	25.3	4.2	53	8	7

a/ Results of thirty cassava Regional Yield Trials conducted by Hung Loc Agricultural Research Center in central and south Vietnam (2001-2005).

There has a great achievement in cassava yield and output. During the 1980s and 1990s cassava production in Vietnam was in decline. But in the past six years, cassava production increased from 1.99 million tones in 2000 to 7.71 million tones in 2006. (**Figure 5**) Cassava in Vietnam has rapidly changed its role from a food crop to an industrial crop, with a high rate of growth during the first years of the 21st Century.



1.2 Review of cassava processing and market in Vietnam

There are now 60 cassava starch factories in operation with a total processing capacity of 3.2-4.8 million tons of fresh roots/year. Vietnam has recently developed an E10 policy requiring the production of 100 to 150 million liters of fuel-ethanol from cassava per year. Vietnam is now the second largest exporting country of cassava products while animal feed factories also contribute significantly to the increasing demand for cassava roots.

2.3 Case study of cassava market in the Central provinces

The average labour requirement is 125 mandays/ha. The second largest cost item is fertilizer, constituting 41.8% in Binh Dinh and 24.7% in Gia Lai, depending on farmers' investment in fertilizer. With the selling price of fresh root of 900 VND/kg; farmers can earn 10,720 to 11,200 thousand VND/hectare. The total variable cost of cultivation in 2007 was about US$ 455- 567.5/ha, at an average root yield of 22.0 t/ha, the production cost would be US$ 20.68-25.79 /t fresh roots. Gross income is US$ 1,155- 1,237.5 /ha. Net income is US$ 670 - 700/ha

2. THE SELECTION OF CASSAVA DOUBLED HAPLOID (DH) LINES DERIVED FROM CIAT

The introduce and development of cassava doubled haploid (DH) plants from CIAT could become an important tool to support hybrid cassava breeding (Zaida Letini, Hernan Ceballos 2003; Hernan Ceballos et al. 2007a. Hernan Ceballos et al. 2007b). Some promising doubled haploid (DH) lines were made, evaluated and test crossed in the field. In the 2001-2007 period, a total of 24,073 sexual seed, new hybrid cassava elite clones from CIAT and 37,210 hybrid seeds from 9-15 cross combinations in Vietnam, 38 breeders' varieties, 31 local farmers' varieties, were planted at Hung Loc Center and Nong Lam University. Of these, 344 accessions of cassava were selected, maintained, and evaluated for priority traits (**Table 7**). Results of the selection, 98 cassava varieties were the best. KM140 is a supplementary variety for main variety KM94 in order to extend harvesting time, which are now ready for release.

3. LESSONS LEARNED FROM THE VIETNAM CASSAVA PROGRAM AND THE POTENTIAL OF CASSAVA AS A BIO - FUEL

3.1. Lessons learned from the Vietnam Cassava Program

Six essential conditions for a successful cassava R&D program include: Materials, Markets, Management, Methods, Manpower and Money (6 Ms). Main experiences in linking cassava R&D activities in Vietnam include: 1) Establishment of the Vietnam Cassava Program (VNCP) including advanced cassava farmers, researchers, extension worker, managers of cassava research and development projects, cassava trade and processing companies, and 2) The establishment of on-farm research and demonstration fields (farmer participation research FPR), and 3) Ten mutual link-up activities (10 T – in Vietnamese).

3.2. The potential of cassava as a bio - fuel

Using cassava in bio- ethanol production is also a growing interest in Vietnam. Petrosetco and Bronzeoak are investigating the possibility of a 150 million litre plant in central Vietnam. Both plants will draw ethanol from tapioca chips sourced from within Vietnam, according to sources close to the projects. Media reports placed the investment values at around US$80 million to US$100 million for the joint venture between Petrosetco and Itochu, and US$138 million for the project with Bronzeoak (Energy Current 2008).