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6. RESULTS OF HYBRID MAIZE RESEARCHING AND PRODUCING IN VIETNAM

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ABSTRACT

Maize research in Vietnam started in 1952 with the establishment of the Institute of Crops Production Research, now known as the Vietnamese Academy of Agricultural Sciences. From the late 1950s to early 1960s maize research was led by Hanoi Agricultural University and the Institute of Agricultural Science for Southern Vietnam Since 1971, when the Maize Research Institute (MRI) was founded, research on maize, especially hybrid maize, has developed in a systematic way parallel to high level global standards. After 40 years of research, especially from 1992 until now, the hybrid maize's revolution has been the main factor for maize development in Vietnam. Thirty eight nationally recognized hybrids including field corn, waxy corn, sugar corn, baby corn, high-quality protein corn, etc. have been kept up with targets: high yield, drought resistance, early maturity. Hybrid maize production and trading have brought the high efficiency for maize production in nationwide.

Key words: Hybrid, maize, research, production.

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I. INTRODUCTION

Maize plays an important role in agricultural development in Vietnam. From its establishing in 1952, the Institute of Crops Production Research has conducted studies on breeding of open pollinated varieties, seasonal cropping and technical culture.

Since the establishment of the Maize Research Institute (1971), research and use of hybrid maize varieties have developed in the systematic way as:

- Development of inbred lines (parental lines)
- Evaluating the combination of inbred lines
- Developing new hybrids from the promising crosses.

Transferring hybrid seed into production has contributed since 1992 in increasing productivity and total national maize production, resulting in national maize producing accounting for an increasing proportion, and now dominant proportion, of global maize productivity.

Table1. Average maize yield of Vietnam and the World

Year	Viet nam (tons/ha)	World (tons/ha)	Comparison of Vietnam's and world's maize yield (%)
1985	0.149	0.34	43.8%
2000	0.25	0.42	60.0%
2005	0.36	0.49	73.0%
2010	0.409	0.506	80.8%

Vietnam's maize productions exceeded the main level of 1; 2; 3 and 4 million tons in the yeas of 1994; 2000; 2003 and 2007.

Table 2. Growth rates of area, yield, production of maize in Vietnam and in the world during the period 1985-2010

Average annual growth (%) (1985-2010)	Vietnam	Global
Area	7.9	0.8
Yield	6.7	2.1
Production	25.8	3.15
2010	0.409	0.506

Table 2 shows that during the period 1985-2010, the growth rates of area under maize cultivation, yield, and maize production in Vietnam were higher than average global rates.

II. CONTENTS AND METHODS OF TECHNOLOGICAL TRANSFERRING

1 - Research results were compiled from project reports from projects the MRI has implemented since 1971.

2 - Transferring new varieties and technical procedures are curried under the following ways: jointing venture; cooperation and transferring Author rights under the regular legislations such as: commercial law, technological transfer law, corporation law…

3 - Contents of this paper include research results of hybrid maize breeding, production and business results maize varieties - the advantages and challenges. The orientations of research and trading production of hybrid maize seed period 2012-2015 as well.

III. RESEARCH RESULTS

3.1. Gene pool collecting

Since 1971, about 30 local maize varieties have been collected. From 1971 to 1979 many local and imported maize samples have been collected from VIR (Federal Republic of Russia); hybrid maize varieties from China, Bulgaria, Hungary, India and importing pure lines from China, India, Japan, Yugoslavia.

From 1980, MRI's cooperation and CIMMYT has been started and source materials which originated tropical maize have been brought into Vietnam by International Progenies Testing Trials (IPTT) and Elit Variety Trials (EVT).

The hybrid maize varieties which the foreign companies has sold in Viet Nam have been rich for maize breeding material sources of MRI that has been foundation to bred high heterotic and diversified in types.

3.2. The results of hybrid maize breeding from 1992 to 2011

Since 1971, corn hybrid maize breeding has been concerned at MRI, till 1986, some high yield combinations such as NVxTQ2, GG5xLV, and N51xGG5 were initially identified. However, hybrid maize can not be conducted because:

- Agricultural production followed co-operative, low investment (extensive farming), lacking hybrid seed production systems.

- The custom of farmer was to use pure varieties that bred in next season.

- High price seed was difficult to accept in the subsidy management.

Open-pollinated varieties, synthetic varieties and composite varieties were developed largely because those were suitable cultivation level and low investment at that time.

From 1992, due to suitable produced conditions, conventional hybrid and non-conventional hybrid maize varieties were bred by MRI. Some double top crossed varieties have been recognized as the national varieties and accepted in production.

LS3, LS4: early maturity varieties;

LS4, LS5 and LS6: medium maturity varieties;

LS7 and LS8: late medium maturity varieties.

Non-conventional hybrid maize varieties were accepted in production because those were superior to the open-pollinated variety (OPV) about: yield, quality, uniformity and seed prices were lower than OPV 2-3 level.

At the same time, conventional maize hybrid varieties which were bred such as: LVN6, LVN12 and LVN19 were transferred to production in the first time. There were advantages and the difficulties in that time:

- Hybrid seed price were quite high (they were higher than commercial price about 10-15 times), the effective which were eliminated increasingly cost were 13-14 million dong/ha in comparison with cultivation of pure varieties if properly cultivation.

- Needed conditions high intensive investment in maize production to promote high yield potential.

The period from 1995 to now, there are 38 varieties which have been recognized as the national varieties and diverse types being accepted in production of nationwide.

Early maturity varieties: LVN5, LVN20, LVN25, LVN885, LVN22, LVN99, and SB099.

Medium maturity varieties: LVN4, LVN9, LVN17, LVN24, LVN31, LVN32, LVN37, LVN184, LVN45, LVN145 and LVN68.

Late maturity varieties: LVN10, LVN98.

High quality protein varieties: HQ2000, LVN14, LVN154.

Drought-resistant varieties: VN8960, LCH9, LVN145, LVN146, LVN81

Glutinous corn: NL1, NL5, NL9

Sugar corn: DL10, DL20.

Baby corn: LVN23

Intensive varieties (10-12 tons/ha): LVN61, LVN66, LVN14 and LVN092.

3.3. The results of production and trading from 2005 to 2011

3.3.1. Advantages and challenges in production - business maize of Vietnam

*** Advantages**

- Productivity and genetic quality of Viet Nam's hybrid maize varieties have been as same as multinational companies in our country, more and more new varieties have released from research institute.

- From 2000 to now, The State has had special investment through the hybrid maize's development project and The State's policy in corn production has been more flexible.

- Viet Nam hybrid maize trademark have enlarged whole nation.

- Vietnam had initial success in researching, production and business of hybrid maize.

- The facilities for research, seed processing and preserving have being upgraded.

- Low price which were appropriated 60-70% imported seed price, wage costs and business surcharge were low, and the variety copyrights were at the lowest level.

- Because of the impaction of science and technology it has been improved yield, seed quality and increased production in many seasons and regions.

*** Challenges**

- Viet Nam's maize hybrid varieties have had to compete with maize varieties of multinational companies in Vietnam from 1992 to present.

- Requirements for maize production have increased such as: productivity, quality, tolerance, packing sample...)

- Transgenic maize has been tested in Viet Nam, this is a huge challenge for our country's maize research.

- Seed production has been used craftsman, depended on natural conditions, so yield and seed quality have been not stable.

- Some criteria quality of Viet Nam such as uniformity of seeds, germination capacity, and preserving time... has been lower level than those of advanced countries.

- Organize ability of business and investment which has been expanded the new variety market was less than foreign companies.

3.3.2. Some associated forms with enterprises for hybrid maize production and business

With 4 main associated forms in the hybrid maize production and business:

(1) MRI has sold parental varieties for enterprises producing and selling, paid copyrights to the MRI on the production areas.

(2) Enterprises have produced seeds; MRI has been got benefit of selling price and cost.

(3) Enterprises have bought parental seeds from MRI, partly sold to the MRI, the remaining trading on their area business.

(4) Enterprises have purchased of hybrid seed copyrights of MRI - renamed for the varieties - initiative production - business.

Following forms, MRI's maize varieties were quickly accepted into production, enough competitive (in that time) with other foreign companies because:

- Mobilized capital investment for seed production and processing which MRI has not had;

- Mobilized the facilities for production and business activity;

- MRI's product trademark - Enterprises produced that they were responsible to consume.

- Enterprises have bought the MRI's new varieties copyrights, so they have focused on investments in production-business activities.

3.3.3. The results of MRI's hybrid maize production and business activity

Since 1992 MRI's hybrid maize varieties have competed with the Company's joint venture. Each year MRI has provided about 2100-3300 tons of seeds to production, in addition MRI has sold some parental seed varieties to domestic companies. MRI sold 7 hybrid maize variety copyrights for foreign companies and domestic companies: LVN14, LCH9, LVN154, LVN145, LVN66, LVN37, and LVN68. Beside, MRI has been selling hybrid seeds for Laos, Cambodia and other countries in the region.

Production and trading MRI's research products have contributed stabilize seed quantity and price on nationwide about 100-120 billion per year.

Table 3. The results of hybrid maize variety production-trading in the period of 2005-2011

Results	2005	2006	2007	2008	2009	2010	2011
Sold variety quantity by MRI	2100	2450	3000	3300	2800	2600	2400
Sold variety quantity by domestic companies (using MRI's parental lines) (tons)	5500	5000	6100	6000	5500	5000	4600

3.3.4. The orientations of hybrid maize variety research and production - business in period of 2012-2015

*** The breeding**

- Researching, selecting and developing corn varieties with high yields (12-13 tons /ha) for intensive farming areas;

- Researching, selecting and developing resistant and tolerant maize varieties (drought, alum, flooding and low-intensive investment...) for the poor;

- Researching, selecting and developing transgenic maize to tolerant drought, resistant herbicide and Bt in order to select 2 transgenic maize varieties for production;

- Researching, selecting and developing sugar corn, glutinous corn, baby corn and QPM for production;

- Researching, selecting and developing open-pollinated maize varieties for production in the poor.

*** The cultivated techniques**

- Research cultivated techniques on sloping land;

- Research ICM on hybrid maize for main regional production.

*** The orientations of research products production and business activity**

- To strengthen the business units under MRI, especially in Son La Branch, especially DakLak brand's MRI and some other provinces, striving for output quantity will be 3,500-4,000 tons per year.

- To co-operate with domestic companies, to diversify product trading, to export maize to Laos, Cambodia, Indonesia and other countries;

- To sell new varieties copyrights and technological processing licensing for foreign companies and domestic companies; to transfer Consulting and investment Company for maize Development to Joint-stock companies organization for products rapidly into production;

- To innovate seed producing and processing technologies, improve product quality, lower costs;

- To develop product distribution networks, market information to respond promptly the change.

IV. CONCLUSIONS AND RECOMMENDATIONS

About 80% of MRI's research products was transferred into production, 20% of the remaining products was stopped because of the dominance of better following products. Science1992, the hybrid maize varieties which were created by MRI has contributed significantly to production and increased yield and productivity. Income from hybrid maize variety business and production has helped MRI to invest more in research, training and modern facilities. Being application research organization, MRI is always under pressure of the market and modern science and technology, Maize Research Institute and the sub-institutes of Vietnamese Academy of Agricultural Sciences (VAAS) are conducting the product research into production for agricultural sustainable development in the country.

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7. SELECTION OF TARO VARIETY MDH.01 IN SOUTHERN COASTAL CENTRAL AND HIGHLAND OF VIETNAM

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ABSTRACT

The taro variety MDH.01 with high quality and yield and resistant diseases has been selected, there attain to 24.03 tons fresh tuber/ ha in Phu Yen province and 27.88 tons/ha in Gia Lai province (that higher than the control treatment about 37.7 – 42.9%). It has the growth duration around 9 – 9.5 months, high bulb rate.

Keywords: MDH.01, Taro, Variety selection, *Xanthosoma sagittifolium*, tuber for Southern Coastal Central and highland of Vietnam.

I. INTRODUCTION

Land and climate in the Southern Coastal Central provinces and Central Highlands are suitable for the growth and development of taro (*Xanthosoma sagittifolium*). It is mainly cultivated in the mountainous districts in these provinces. However, since 2001/2002, tuber and root rot disease has caused severe damage to taro cultivation with its area declining by almost 40%. This has severely impacted on household economy. Therefore, there is urgent need for study and selection of a suitable taro variety for the Southern Coastal Central region and Central Highlands.

The present study was conducted to identify suitable taro varieties based on growth, yield, disease resistance and boiling quality and conduct their trial production demonstration.

II. MATERIALS AND METHOD

During 1993-2004, 80 varieties of taro were collected in Vietnam. From these, 13 promising varieties were identified for inclusion in a trial. Of these 13 varieties, 11 were collected from the

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