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THE PROGRAM FOR THE PRODUCTION OF CERTIFIED CITRUS NURSERY TREES AT THE AGRICULTURAL DOMAINES IN MOROCCO

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SUMMARY - After a prosperous era in the fifties and sixties, the Moroccan citrus industry started to encounter constraining problems of low yields and poor quality due to the widespread prevalence of virus and virus-like diseases. Attempts to counter this situation by setting up a voluntary certification program failed to alter the situation. However, incentives such as financial subsidies for the use of certified plants incited major citrus nurseries to adopt the certification program. Agricultural Domaines initiated their certification program in 1997 through the Plant Control Unit in Rabat where sanitation and indexing facilities were installed. Selected varieties and clones have been sanitized and conserved. Categories of materials required by certification regulations are produced and maintained under screenhouse conditions. The Domaines nurseries in the Rabat and Agadir regions are assisted and supplied with certified budwood of 24 appraised commercial varieties and certified rootstock seeds for production of certified citrus nursery plants.

Key words: Citrus, virus, virus-like agent, certification, Morocco.

RESUME *- Après une période de prospérité durant les années 50 et 60, l'industrie agrumicole Marocaine s'est trouvée confrontée à des problèmes contraignants de faible rendement et de qualité dépréciée, à cause d'une large prévalence des viroses et de maladies de type viral. Les tentatives de faire face à de telles difficultés en lançant un programme de certification volontaire n'ont pas permis de redresser complètement la situation. Cependant, les mesures d'incitation pour promouvoir l'utilisation de plants certifiés ont induit les principaux pépiniéristes à adopter un programme de certification. Les Domaines Agricoles ont entamé leur programme de certification en 1997 par le biais de l'Unité de Contrôle des Plants (UCP) à Rabat où des structures d'assainissement et d'indexage ont été installées. Les variétés et clones sélectionnés ont été assainis et conservés. Les catégories de matériel requises par la réglementation de la certification sont produites et conservées sous abris. Les pépinières des Domaines dans les régions de Rabat et Agadir sont assistées et approvisionnées en greffons certifiés de 24 variétés et clones commerciaux et en semences certifiées de porte-greffes pour la production de plants d'agrumes certifiés.*

Mots clés*: Agrumes, virus, agents de type viral, certification, Maroc.*

INTRODUCTION

In Morocco, until the 1970's, there was a wide diversity of citrus varieties and cultivars which started to be abandoned due to their low performance. The first sanitary assessment operations carried out in the orchards indicated a high incidence of virus and virus-like diseases (N'hami and Bourge, 1974). The subsequent grove reconversion by top-grafting with market-demanded clones, using budwood collected from the field, contributed to further dissemination of diseases (Nadori, 1979). As a result, the Moroccan citrus industry underwent striking changes such as the decrease in yield, vigor and productive life of orchards, thus inflicting heavy economic losses to the country's economy. The citrus professionals and officials jointly made considerable efforts to draw up regulations and implement a certification program for citrus nursery tree production (Anonymous, 1984). The detailed scheme for citrus certification in Morocco has been published by Nadori *et al.,* (1986). However, its application was not mandatory and a large amount of planted trees were still supplied by small nurseries not complying with the certification program. Problems related to graft-transmissible diseases (mainly psorosis and

stubborn) and clonal mixtures were observed in the orchards planted with this material in contrast with groves where certified budwood was used.

In 1997, a decree was issued to promote the use of certified citrus nursery trees for new plantings (Anonymous,1999).

The Agricultural Domaines nurseries upgraded their production system and practices to meet the requirements of the citrus certification program. This paper describes the procedure followed to produce certified citrus nursery trees.

REVIEW OF THE CITRUS CERTIFICATION SCHEME IN MOROCCO

The citrus certification scheme in Morocco is based on the same concepts as those adopted in other citrus-producing countries in the world especially in California and Spain (Jelloul, 1998).

- The initial foundation block, established in the open field from reference mother trees, indexed for diseases of major concern or economic impact in Morocco i.e. tristeza, psorosis, stubborn, exocortis and cachexia.
- The *Foundation Block*, which consists of 6 potted trees grafted onto 3 different rootstocks, maintained under screen cover and indexed for the above mentioned diseases with trueness-to-type assessment.
- The *Prebasic Block* (Prebasic material), which consists of 9 potted trees propagated from the Foundation Block, grafted onto 3 different rootstocks maintained under screenhouse and indexed systematically for diseases as indicated above.
- The *Increase Block* (Basic material), which consists of few hundreds to few thousands of trees propagated from the previous types of material and maintained for production of certified buds for three years and tested at random every year for insect-transmitted (tristeza and stubborn) and mechanical transmitted diseases (viroids).
- The *Mother Block* (certified rootstock seed production), which consists of true-to-type rootstock trees indexed for psorosis every 5 years. Fruit production is evaluated before harvest. Seeds are extracted, cleaned, heat-treated and fungicide-rubbed. Certified seeds are kept at 8°C for up to two years.
- *Nursery* (Certified nursery plants), which consists in the production of certified plants using certified buds from basic material and potted rootstocks under screen/plastic house. They are inspected and tested at random for insect-transmitted diseases (tristeza and stubborn).

CERTIFIED CITRUS NURSERY PLANT PRODUCTION PROTOCOL AT THE AGRICULTURAL DOMAINES

The Agricultural Domaines initiated a program for citrus certification at the Plant Control Unit (UCP) in Rabat area, where the basic technologies for diagnostic tests (ELISA, Electrophoresis, pathogen culturing, RT-PCR), biological indexing, and sanitation by thermotherapy/shoot-tip-grafting (STG) have been developed. As stated by the Moroccan certification programme, clonal selection has been carried out in various citrus-producing areas where the best mother trees have been selected. Budwood is collected and propagated by grafting in the greenhouse. After thermotherapy /STG, the regenerated material is indexed to Mexican lime for tristeza and related diseases, Carte Noire clementine is used as the index plant for psorosis and related disease, Madame Vinous sweet orange for stubborn indexing and Etrog citron for viroids. Biological indexing is backed up by laboratory tests including ELISA for CTV (Cambra *et al.,* 1991) and occasionally IC-RT/PCR (Nolasco *et al.*, 1993) with Mab-based kits (Zemzami *et al.,* 1993), electrophoresis for RNA detection of viroids (Duran-Vila *et al.*, 1988) and culturing of S*piroplasma citri* for stubborn (Chang, 1989). All indexing operations and tests are carried out in our facilities under the supervision and control of the Plant and Seed Control Administration (DPVCTRF) of the Ministry of Agriculture. Healthy plants which have been recovered are maintained as replicates in the Conservation Repository under screenhouse. After assessing the trueness-to-type, the budwood is collected to produce mother block material (6 trees onto 3 rootstocks "Sour orange, Troyer or Carrizo citrange and *Citrus Volkameriana*). The prebasic material consisting of 9 trees on 3 different rootstocks are planted in 40 l plastic containers and kept in a screenhouse. The basic material is propagated from the above materials under similar insect-proof conditions and used for production of certified budwood (Figs. 1, 2).

CERTIFIED ROOTSTOCK SEED PRODUCTION

Mother trees for rootstock seed production are selected mainly in germplasm blocks. They are inspected for abnormalities and trueness-to-type and indexed for psorosis every five years. Selected mother trees are visually inspected before harvest to evaluate their production. Seed extraction is made only on fruits directly harvested from the tree. Fruits are washed under tap water and dipped in 10% sodium hypochlorite for 5 to 10 min. A round cut is made at midpoint, then the two parts are twisted off and squeezed on a screen over the sink. Seeds are washed thoroughly and only fully developed seeds are collected. They are heat-treated at 52°C for 10 min. Drying is done in a forced-air cabinet with screen-shelves at room temperature. Seeds are treated with a fungicide powder (80% Mancozeb), kept in sealed plastic bags at 8°C and used within a maximum of two years.

CERTIFIED NURSERY PLANT PRODUCTION

The Agricultural Domaines have two citrus nurseries in the Rabat and Agadir areas. They are both assisted by UCP for the fulfillment of the certification program requirements. Certified seeds, provided by UCP with a letter of transfer addressed to the local Plant Control Service, are planted in single-cell containers (SC-10 Super Cell, Stuewe & Sons, Inc, Oregon, USA) containing a steam-sterilized substrate made of alluvial sand and peat moss (2/1) (Fig 3).

Rootstock seedlings are transplanted into 10 L plastic pots with the same substrate (non-sterilized). They are grafted 6 to 12 months later with certified buds using top- or side-grafting, depending on the width of the rootstock, 20 cm above the soil level. Certified buds are provided by UCP as fresh ten- eye-budsticks packed in sealed plastic bags.

ACHIEVEMENT OF THE CERTIFICATION PROGRAM AT AGRICULTURAL DOMAINES

The major benefit deriving from the Agricultural Domaine certification program is the sanitation of over one hundred varieties and cultivars. A highly-demanded set of 24 commercial varieties has been declared and admitted for certification (Table 1). The nursery technical practices for plant production have been improved and optimised to master mass production of certified nursery plants of high quality at a competitive price. Single-cell planting of rootstocks as been introduced successfully into Morocco and proved effective for selection, grading and transplanting of rootstock seedlings at an early stage of their development. Top-grafting (Nadori *et al.,* 1986), commonly practiced in our nurseries, makes it possible to use large amounts of small-sized buds with higher graft-success rates (over 90%) and faster and uniform shoot development (Fig 4). All these factors have contributed to the success of this experience and revived the citrus nursery business at the Domaines.

The citrus certification program had a considerable impact on the development of the citrus industry at the national level. The yearly production of registered nurseries in Morocco has reached a production of about one million certified plants. The SODEA nurseries produce about 600 thousand plants and the Agricultural Domaines nurseries produce 400 thousand plants. The impact of certified material on plant vigour and development and the impressive yields obtained within 3 to 4 years post-planting have greatly raised the interest of growers. The renewal of old groves and the establishment of new plantings have been promoted far beyond expectations despite the problems of drought, increasing production costs and the greater difficulties of access to foreign markets. The demand for certified plants is constantly growing. Yet, the official bodies responsible for production, control and certification have received additional applications from nurseries which intend to be registered for certified citrus nursery plant production.

The citrus certification program in Morocco has become a success story which is being extended to other crops and commodities.

REFERENCES

Anonymous, 1984. Arrêté du Ministère de l'Agriculture et de la Reforme Agraire N°1478 du 21.12.83. Bulletin officiel N°3718 du 1er Février 1984.

Anonymous, 1999. Arrêté conjoint du Ministre de l'Agriculture, du Développement Rural et des Pêches Maritimes, du Ministre d'Etat, Ministre de l'Intérieur et du Ministre de l'Economie et des Finances N°684-99 du 29 Avril 1999. Bulletin Officiel N°4708 du 15 Juillet 1999.

Chang C.J., 1989. Nutrition and cultivation of Spiroplasmas. In: The Mycoplasmas Vol 5, R.F. Whitcomb and J.B. Tully, (eds). Academic Press, New York: 201-241.

Cambra M., E. Camarasa, N.T. Gorris, S.M. Garnsey and E. Carbonell, 1991. Comparison of different immunosorbent assays for citrus tristeza virus (CTV) using CTV specific monoclonal and polyclonal antibodies. In: *Proc. 11th Conf. of IOCV*, Orlando, Florida 1989, University of California Riverside: 38-45.

Duran-Vila N., C.N. Roistacher, R. Rivera-Bustamante and J.S. Semancik, 1988. A definition of citrus viroid groups and their relationship to the exocortis disease. *J. Gen. Virology* 69: 3069-3080.

Jelloul B., 1998. La certification des agrumes au Maroc. In: Proc. of the Mediterranean Network on Certification of Citrus: activity 1995-1997, *Options Méditerranéennes*, Series B/21, CIHEAM publications: 21-26.

Nadori E.B., 1979. Diversification des porte-greffes comme moyen de protection et de prévention du verger agrumicole marocain contre certaines affections (virus, maladies cryptogamiques). Réunion DEPP, Rabat, Maroc, 1979.

Nadori E.B., A. N'hami and M. Tourkmani, 1986. Programme d'amélioration sanitaire et de certification des agrumes au Maroc, *EPPO Bulletin* 19: 239-243.

N'hami A. and J.J. Bourges, 1974. Sélection sanitaire en agrumiculture au Maroc. In: *Comm. Agrotech. COMAP*. Alger, Fév. 1974: 37-48.

Nolasco G., C. de Blas, V. Torres and F. Ponz, 1993. A method combining immunocapture and PCR amplification in a microtiter plate for the detection of plant viruses and subviral pathogens. *J. Virol. Methods*, 45: 201-218.

Zemzami M., J.H. Hill, R.A. Van Deusen and E.B. Nadori, 1993. Characterization of monoclonal antibodies raised against citrus tristeza virus in Morocco. In: *Proc. 12th Conf. of IOCV*, New Delhi, India 1992, University of California, Riverside: 93-99.

Tab. 1. Certified Citrus varieties and clones declared by the Agricultural Domaines

Clementines	**Oranges**
- Aïn Taoujdate	Blood
- Azemmour	- Washington sanguine
- Berkane	Navels
- Cadoux	- Washington navel
- Carte Noire	- Lane late
- Marisol	Others
- Nour	- Maroc late nucellar
- Nules	- Maroc late nucellar (GC)
- Sidi Aïssa	- Maroc late vc (SA-II)
Mandarins	- Maroc late vc (Zahiria)
- Afourer	- Salustiana
- Nova	- Valencia late Frost
- Ortanique nucellar	**Lemons**
- Ortanique vc	- Eureka
	Grapefruits
	- Star Ruby

Fig. 1. Foundation Block and Prebasic Block of citrus varieties and clones declared in the Agricultural Domaines certification program.

Fig. 2. Increase Block (Basic material) of citrus varieties and clones declared in the Agricultural Domaines certification program

Fig. 3: Seedlings of certified Carrizo citrange for use as rootstocks

Fig. 4. Top-grafting (left) and side-grafting (right) of citrus.