Protected culture in Morocco

Choukr-Allah R.

in

Choukr-Allah R. (ed.).
Protected cultivation in the Mediterranean region

Paris : CIHEAM / IAV Hassan II
Cahiers Options Méditerranéennes; n. 31

1999
pages 9-15

PROTECTED CULTURE IN MOROCCO

R. CHOUKR-ALLAH
Institut Agronomique et Vétérinaire Hassan II, Complexe Horticole d'Agadir, Agadir, Morocco

Abstract: Morocco protected cultivation is based on unheated greenhouses. The estimated area of protected culture is estimated at 8,540 ha including vegetables, cut flowers and fruit crops. The main vegetable crops are tomato, melon, watermelon, pepper, green beans and strawberries. Roses and carnation are the leading cut flowers and banana and grapes are the major fruit crops cultivated under plastic. At the present time, the protected cultivation industry is moving from the northern to the southern part of Morocco. Trends in plastic greenhouse structure are changing from the hemi-cylindrical quonset type to multispan structures as well as the canarian type. Strong competition within the Mediterranean countries is forcing the plasticulture industry in Morocco to look to the development of a new structure as well as new agrotechnology to improve the quality of production at a lower cost. The change in protected culture operation and technology in the last ten years has been unprecedented in Morocco. Fertigation, long shelf-life cultivars, bumblebee pollination, geothermal heating, mulching, substrates culture, integrated pest management, to name but a few, are becoming recognized as regular greenhouse practices. The development of new markets and intensive competition within the Mediterranean countries to produce a high quality product has shifted public attitudes vis-à-vis protected culture production from simply growing crops toward entreprise management.

INTRODUCTION

Unheated, plastic greenhouses are of great importance in Morocco's agricultural economy and bring in a considerable amount of foreign currency. They were introduced in Morocco in the early seventies and increased dramatically after the EEC restrictions were imposed on Moroccan production. This increase was followed by a reduction in the open field production and moving of the greenhouse industry from the northern part of Morocco to the south (Souss-Massa valley) to meet the time schedule imposed by the EEC. At the present time, we see a change even in the cropping system under protected cultivation since Morocco's signature to the GATT agreement. The banana production is decreasing and melon and strawberry production increasing. The estimated protected cultivation in Morocco is about 8,540 ha including vegetables, cut flowers and fruit tree crops. The main greenhouse structures are the multispan and the canarian type for fruit tree crops and flowers and the hemi-cylindrical quonset type for vegetable crops. This paper will describe the level of production under protected cultivation as well as the level of technical technology used and some economic characteristics of this intensive agriculture.

PROTECTED CULTIVATION: ACREAGE, CROPS AND GEOGRAPHICAL DISTRIBUTION

Statistics available concerning protected cultivation in Morocco are generally limited to censing by the regional extension offices (ORMVA's) and the provincial agriculture office (DPA's). In 1996, the total surface area of protected cultivation was estimated at 8,540 ha. The area dedicated to vegetable crops is dominated by tomato crops: 2,935 ha (56%); strawberry: 935 ha (17.7%) and melon: 609 ha (11.5%). Pepper, cucumber and green beans (Table 1) cover the remaining acreage. Banana production under plastic greenhouses reached acreage of 2930 ha in 1995. However after the canceling of restrictions on banana imports, we are expecting a decrease in banana production.

Most of the protected cultivation is concentrated along a narrow, relatively frost-free area of the Atlantic coast between Larache and Agadir and as far as Dakhla which receives abundant light during the period October - March (from 1150 to 1400 hrs).

Table 1. Vegetable crops under greenhouse 1994/95 season

Crop	Acreage (ha)	Production (T)
Tomato	2 935	319 000
Strawberry	935	35 000
Melon	609	21 700
Pepper	434	31 200
Cucumber	142	13 500
Hot pepper	43	4 500
Green bean	29	900
Courgette	9	850
Water melon	5	350
Egg plant		200
Total	**5 270**	**427 500**

MAMVA 96

Sixty percent of protected vegetable crops are located in the south of Morocco (Souss-Massa valley) with a total area of 3162 ha in 1995. The region of El Jadida ranks second with 801 ha, followed by the region of Casablanca (352 ha). During the last two years, there has been a decrease in acreage in the northern part of Morocco and a dramatic increase in the number of plastic greenhouses in the Souss-Massa valley. This increase is due to new constructions and also to the transfer of some greenhouses from the northern part of Morocco. The development of protected culture for tomato in Morocco was followed by a decrease in open-air production (Table 2). The main area of production of banana is the Souss-Massa valley near Agadir (55% of total production). The remainder is located close to the northern coastal cities of Casablanca, Rabat and the Rabat-Kenitra region (Table 3). The production of flowers under plastic in Morocco presently covers 351 ha, more uniformly distributed among the different regions than the vegetable crops (Table 4). The main regions are El Jadida, Souss-Massa valley, Tadla and Marrakech. The area dedicated to cut flowers is mostly devoted to roses (90%). The remainder is divided among carnation, gladioli and sterelizias.

Table 2. Vegetable crop acreage and production for export

Crop	Acreage (ha)		Production (T)		Exported tonnage (T)	
	1993/94	1994/95	1993/94	1994/95	1993/94	1994/95
UNDER GEENHOUSE	**4 365**	**5 270**	**322 200**	**427 500**	**159 160**	**154 779**
Tomato	2 715	2 935	242 000	319 000	140 987	134 414
pepper	350	434	27 500	31 180	982	1 675
Melon	480	609	19 000	21 675	8 037	7 594
Strawberry	580	935	20 900	35 270	6 996	8 912
Other	240	357	12 800	20 375	2 158	2 184
OPEN FIELD	**14 835**	**14 930**	**325 600**	**209 500**	**131 925**	**134 507**
Tomato	2 950	2 580	133 200	134 000	34 100	25 422
Potato	9 400	10 500	148 500	140 000	83 332	97 210
Other vegetables	2 485	1 850	43 900	35 500	14 493	11 875
Courgette	165	250	4 150	6 250	1 772	1 895
pepper	160	70	5 500	2 880	1 500	100
Hot pepper	80	180	1 600	3 600	1 500	1 645
Eggplant	300	470	7 600	11 700	46	120
Mange-tout	130	60	1 950	900	1 157	588
Green bean	420	425	4 850	4 300	4 550	4 860
Strawberry	90	78	2 000	1 840	-	85
Asparagus	263	227	1 150	1 380	94	212
Cucumber	82	50	2 500	1 950	567	146
Various vegetables	795	40	12 600	700	3 307	2 224
Total	**19 200**	**20 200**	**647 800**	**737 000**	**291 085**	**289 286**

MAMVA 96

Table 3. Banana crops under greenhouse – 1994/95 season

Region	Acreage (ha)		Production (T)	
	1993/94	1994/95	1993/94	1994/95
Souss-Massa	1 580	1 610	40 000	42 300
Gharb	440	530	14 500	20 200
Rabat-Salé	360	365	9 300	10 750
El Jadida	350	350	15 000	15 650
Ben Slimane	120	35	3 500	750
Loukkos	70	14	2 000	120
Khemisset		7		250
Moulouya		7		250
Essaouira		7		30
Casablanca		5		100
Total	**2 920**	**2 930**	**85 000**	**90 400**

MAMVA 1996

Table 4. Area of cut flowers per region

Region	Acreage (ha)	%
Souss-Massa	125	37
Haouz	80	23
El Jadida	70	20
Tadla	30	9
Rabat-Salé	18	5
Ben Slimane	12	3.5
Gharb	5	-
Total	**340**	**100**

MAMVA 96

GREENHOUSE TYPES AND CHARACTERISTICS

The basic greenhouse used for vegetable crops is a structure 3 to 3.4 m high, 9 m wide and 56 m long, covering about 500 m^2. This hemi-cylindrical "quonset" type, with structural elements in aluminum, is well adapted to small farmers. One variant (Delta 9) has 2 lengthwise sheets of plastic covering the house with a central overlap for ventilation. The other (Sucodam) has hemispheric overlapping plastic strips with ventilation achieved by separating the strips. At the present time, this hemi-cylindrical type (Table 5) represents 40% of the vegetable crop greenhouses. The remainder is made of Eucalyptus wood (Canary Island houses). This cheaper method is increasing in popularity particularly in the Souss-Massa valley where it represents 54 % of vegetable crop greenhouses in contrast to the northern part of Morocco where less than 20% of greenhouse structures are of this type. With the increasing price of wood and its rapid decay, there is a tendency to replace wood with metallic tubes. The covering material used in most of these structures is polyethylene film. A small percentage of farmers use polyethylene thermic film.

Table 5. Distribution of protected area per type of shelter

Type of shelter	Vegetables	Banana plantations	Cut flowers	Total	%
High tunnels	2 060	-	36	2 098	24.5
Canar. Types	1 878	1 976	152	4 006	46.9
Multipchapel	217	-	150	367	4.3
Delta 36	-	954	-	954	11.2
Low tunnels	1 115	-	-	1 115	13.1
Total	**5 270**	**2 930**	**340**	**8 540**	**100**

MAMVA 96

For banana production, the basic greenhouse is a structure 5 to 6 m high covering from 0.8 to 1.25 ha. Most houses are 100 m wide and 125 m long permitting a single sheet to stretch front one end to the other. There are many design variations but only two basic types - a wooden pole block-type house or a galvanized steel pipe frame house. The most dominant style is a flat-roofed structure with curved ends. A new construction geared to prevent damage has been on the market over the last 3 years (Tembarello type structure). There is a tendency to use wooden pole block-type houses and, in 1995, they represented 68 % of the total banana area.

Plastic covers are usually 200 µm thick and last for 2 years. Ventilation in these structures is achieved by separating the strips or by lifting the sides or, in some cases, by dropping the sidewalls. The structure of the greenhouse used for cut flower production is dominated by the Multispan type. In the Souss Massa valley the structure of wood and wire prevail over the galvanized tube and wire type. The introduction of plastic greenhouse technology has increased the volume of export vegetables between the months of January and April from 28% to 90% of the total volume exported per year. Total yield as well as the quality of the product has been improved, since the tomato yield increased from 60 to 140 tons per hectare in the last 10 years. Banana yields average 45 tons per hectare, but 90 t/ha has been achieved by some farmers. The average national yield of roses is between 260 000 and 300 000 flowers/ha. Yields of 500 000 flowers/ha can be obtained in greenhouses that provide supplemental heating. Recently, more sophisticated greenhouse structures have been introduced for cut-flower production. They are equipped with automatic control ventilation and double layer plastic to reduce heat loss during winter. Heating of the plastic greenhouse is very unusual and limited to ornamental crops. It is more concentrated in the northern part particularly in the Marrakech area.

SOILLESS CULTURE

One of the main reasons for the development of soilless crops is pathological. In effect, intensive cropping under plastic greenhouses is responsible for soil fatigue leading to a decrease in productivity.

In Morocco, this system is presently used on a small area in some farms. By the year 1989, the total surface area was around 70 ha. The main substrates used were pozzalan rock, mixed gravel and sand. The latter substrates were abandoned because of high pH and high calcium carbonate levels inducing micro-nutrient deficiency. At the present time, only 21 ha are still in production using the pozzalan rock substrates for growing tomato and peach. Several new substrates have been tested including rockwool, perlite, and polymer of urea and organic substrates (Motex and compost). Results show good performances of perlite and polymer of urea and also indicate that crop production and quality in soilless culture were much greater than with soil culture. However, research should be carried on, particularly in view of the expected future expansion of this technology in order to be able to propose precise and environmentally sound policies that certainly can be applied to soilless culture. Once again, it is evident that a strategy of avoiding or minimizing the use of pesticides in soilless culture will be the most appropriate, using these two substrates (perlite and polymer of urea) since they could be recycled and do not present any environment risk when they are incorporated into the soil as amendments.

CROP SYSTEMS AND VARIETIES

Given the limited export season, soil fatigue and high temperatures in summer, Moroccan farmers can only grow one crop per year. This does not allow them to reimburse high investment required for protected cultivation. Further, high competitivity within the Mediterranean basin has encouraged Moroccan farmers to choose the most productive varieties of the highest quality on

the market and post-harvest. Also, all vegetable varieties used under greenhouse are hybrids and the main suppliers are a Dutch company (Sluis & Groot) and an Israeli company (AZURA).

Ninety-five percent of tomato varieties grown are long shelf-life varieties, in particular Daniella. For melon, the majority of farmers grow the Gallia type and for strawberry, the Osso Grande variety predominates. For banana production, two cultivars are used - Large and Small Gavendish.

WATER AND MINERAL NUTRITION

Given that the water resources available in the area where early vegetables are grown are lower than the potential requirement, it is necessary to economize water use. Thus, almost all Moroccan farms use localized irrigation. The irrigation water used comes either from wells or from dams and quality varies from region to region (0.4 to 7 dS/m). Given the scarcity of water and the excessive salinity of underground water, wells are being dug as deep as 120 m in the Taroudant region. In the Oualidia region, the underground water is becoming more and more saline due to the intrusion of seawater into the coastal area. In the Souss-Massa, the scarcity of water has led to the construction of water reservoirs made impermeable by lining with plastic (PE).

Along with micro-irrigation, fertigation is being widely used in order to rationalize the addition of fertilizers and improve the production and quality. However, fertigation management remains archaic as fertilization programs vary enormously based either on Spanish or French data or on locally developed recipes.

POLLINATION

Recently, large-scale farmers have introduced bumble bees for pollination of tomato crops and it is now common practice to use honey bees for melon, watermelon and strawberry. Bumble bees are gradually replacing the manual and mechanical vibrators since they improve the quality of the produce and increase the total yield. Moreover, the introduction of bees in the greenhouse is forcing growers to selective use of pesticides.

PEST MANAGEMENT

Farmers in Morocco are aware now of the dangers of misuse or overuse of pesticides if they are to compete in the European market. To ensure the production of high quality free of residues, farmers are introducing biological control of some insects as well as mechanical means using nets.

ECONOMIC COSTS

Data show that the investment required to install a crop system as described earlier varies between 23.6 and 19.4 DH*/m2, respectively for tomato and melon crops (Table 6). Greenhouses represent between 32 and 39% of the investment depending on the type of greenhouse and the crop, labor represents approximately 20%, miscellaneous expenses, represent 33.4 % of the investment. The production cost of 1 kg of tomato and melon varies, respectively, between 1.69 and 2.15 DH and between 2.43 and 3.2 DH.

Table 6. Importance of different investments for tomato and melon crops under greenhouse

	Tomato	Total %	Melon	Total %
Cost of the land	4 000	1.7	4 000	2
Working the soil	1 000	0.4	560	0.2
Nursery	20 000	8.5	17 750	9.1
Fertilisation	21 400	9.1	12 890	6.6
Training	8 725	3.7	7 200	3.7
Phytosanitary treatment	21 700	9.2	6 600	3.4
Water	6 000	2.5	3 000	1.5
Labor	42 900	18.1	38 500	19.8
Greenhouse	76 000	32.1	76 000	39.1
Financial expenses	34 700	14.7	27 800	14.3
Total	**236 425**	**100**	**194 300**	**100**

ORMVA/SM 1996

However, the cost price of tomato is much higher than the production cost: 6.13 DH/kg (Table7). This is mostly due to postharvest, packing and transport costs as well as taxes and commission. This shows that the profit margin of a tomato crop is very limited and depends on commercial factors and European restrictions on Moroccan products. We can thus understand the Moroccan farmers anxiety to increase productivity and quality by using up-to-date technology to compete within a market which is more and more restricted.

Table 7. Cost price of tomato shipped up to Perpignan, France

	Tomato cost price (DH/kg)*	
	Morocco	Spain
Production cost	1.92	2.46
Postharvest and Packing cost	1.89	1.04
Transportation cost	2.12	0.33
Transit	0.2	0.00
Total	6.13	3.83

* DH ~ 0.1 US$

Source: APEFEL 1996

REFERENCES

APEFEL, 1996. Fiche technique sur le coût de revient d'une culture de Tomate au Maroc. Agadir, Morocco

Castilla Prados N., 1992. XII Congreso Internacional de Plasticos en Agricultura, 3-8 Mayo 1992 – Granada (Espana).

Choukr-Allah, R.; 1991. La situazione nei paesi di Nord Africa. colture protette e ortoflorofrutticultura intensiva. Anna XX, ottobre:49-52.

Janick, J. 1989. Horticulture in Morocco - North Africa's. California. HortScience Vol. 24 no. 1:18-27.

ORMVA/SM, 1996. Bilan de la campagne agricole 1994-95. La tomate et le melon, Agadir, Morocco.

ORMVA/SM, Division de la production agricole, 1996. Rapport sur le coût de la production des cultures primeurs dans le Souss Massa. Agadir, Morocco.

MAMVA, Division de l'Horticulture. 1996. Bilan de la campagne agricole 199-96. Le bananier, la floriculture, les primeurs. Rabat, Morocco.

Sirjacobs, M, 1986. Les cultures protegées au Maroc - choix des régions climatiques. Homme, Terre et Eaux. Vol. 16, no. 62:65-73.