

The use of Methyl Bromide alternatives for cucurbit production

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Conference on Methyl Bromide alternatives

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1-French production, data and characteristics

□ Cucumbers

Production share

42%	3 departments	20,000 t 16,500 t 16,000t	Loire Atlantique Loiret Bouche du Rhône
24%	4 departments	From 4,500 to 10,500 t	Pyrénées Orientales Lot-et-Garonne Meuse Rhône
17%	9 departments	From 2000 to 3500 t	Yonne Haute-Marne Vendée Gironde Maine-et-Loire Indre-et-Loire Aube Vaucluse Nord

Melons

Production share

52%	5 departments	40,000 t 30,000 t 30,000 t 28,000 t 27,000 t	Deux-Sèvres Hérault Vaucluse Vienne Tarn-et-Garonne	
27%	5 departments	From 12,000 to 22,000 t	Bouches-du-Rhône Charente-Maritime Lot-et-Garonne	Gard Gers
9%	4 departments	From 5 000 to 10 000 t	Lot Vendée	Maine-et-Loire Alpes Haute Provence

□ **Courgettes (Zucchini)**

Production share

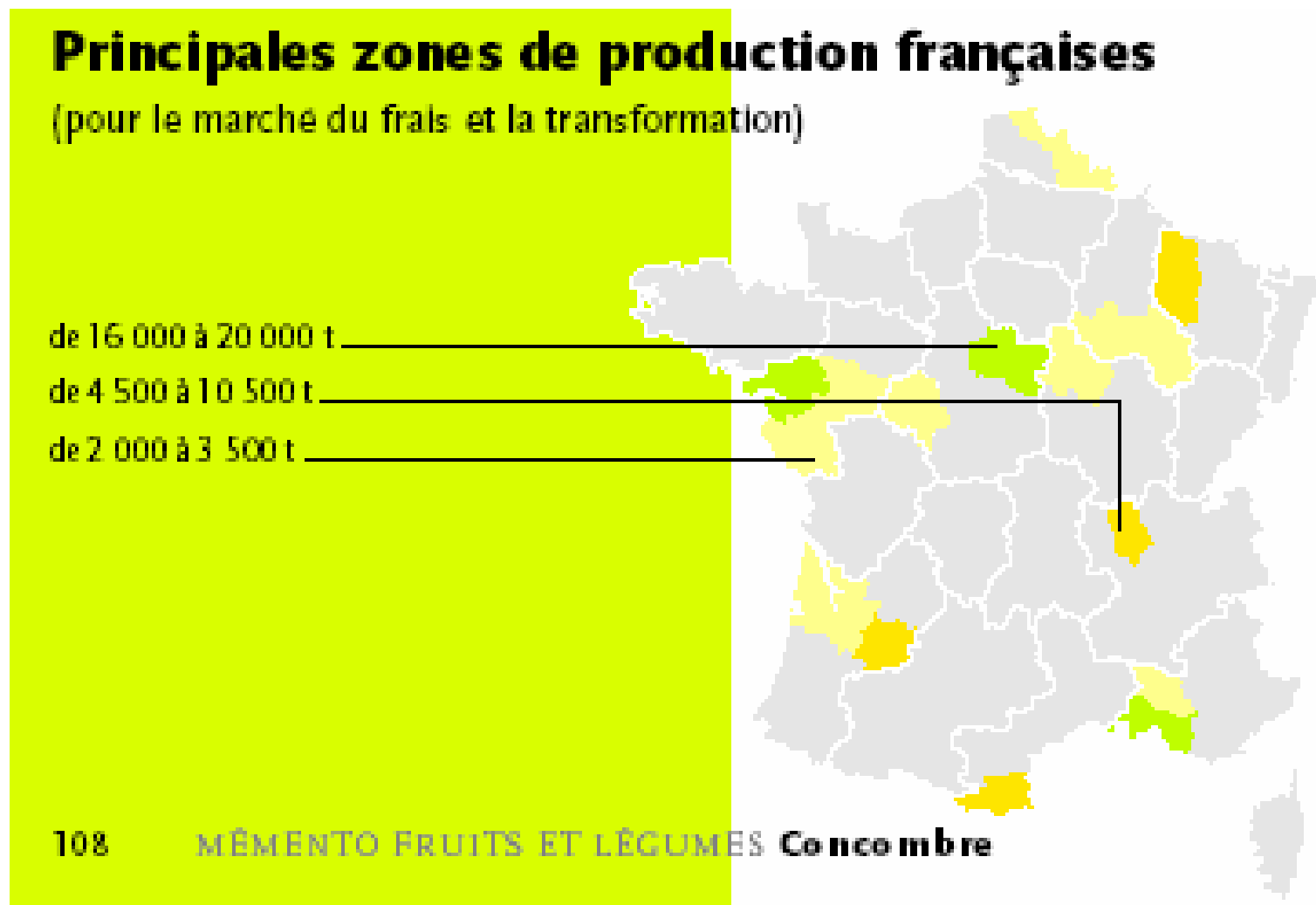
42%	1 department	64,500 t	Bouches-du-Rhône
28%	4 departments	From 6000 to 11,000 t	Vaucluse Gard Nord Lot-et-Garonne
9%	5 departments	From 2000 to 4000 t	Loir-et-Cher Rhône DrômePyrénées-Orientales Tarn-et-Garonne

	Cucumber	Melon	Courgette
Latin name	<i>Cucumis sativus</i>	<i>Cucumis melo</i>	<i>Cucurbita pepo</i>
Protected or open field production	After having doubled in the 80's, French production has continued to progress up to around 130,000 tons per year for a surface area of almost 550 hectares. Most of this surface area is cultivated under protection and almost 75% is cultivated in substrate.	French production has stabilized at between 300,000 and 320,000 t within the last several years, for a total of 16,500 ha. Most of this production is open field (90%) 8-9% under tunnels	After having doubled the 80's, courgette production has increased by 40% over the last 10 years to reach 214,000 t for 4,900 ha of which 1,600 ha is squash and pumpkins. Most of this production is open field.
Proportion of total crop area treated with M.B	20% per year	1% per year	< 0.3%

▣ Cucumbers

Production has been relatively stable over the course of the last three years at around 103,000 t for 550 ha.

Principal zones for French production (for the fresh produce market and that for transformation, according to Brossard, 2002).



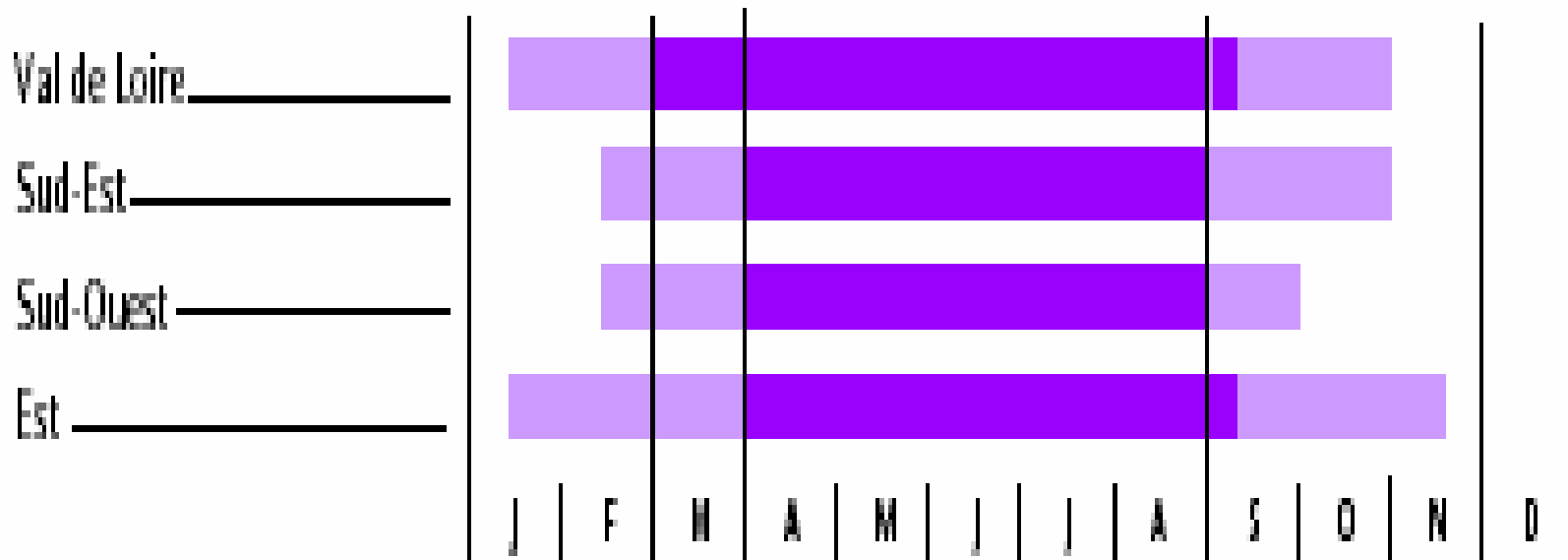
Production calendar (according to Brossard, 2002).

Loire Valley

Southeast

Southwest

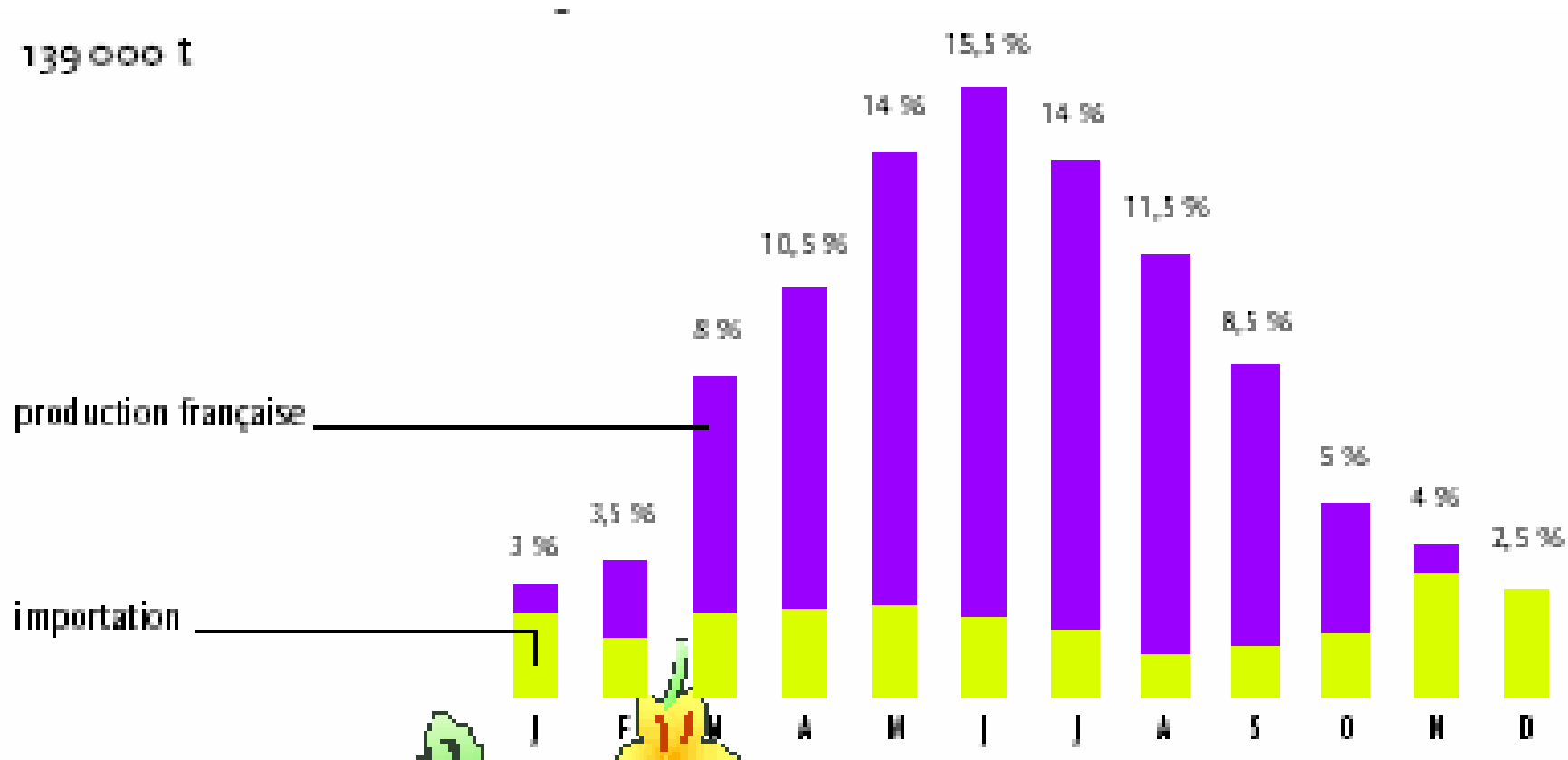
East



Marketing calendar for the French market (according to Brossard, 2002).

French production

Importation



□ Melons

Principal zones for French production (for the fresh produce market and that for transformation, according to Brossard, 2002).

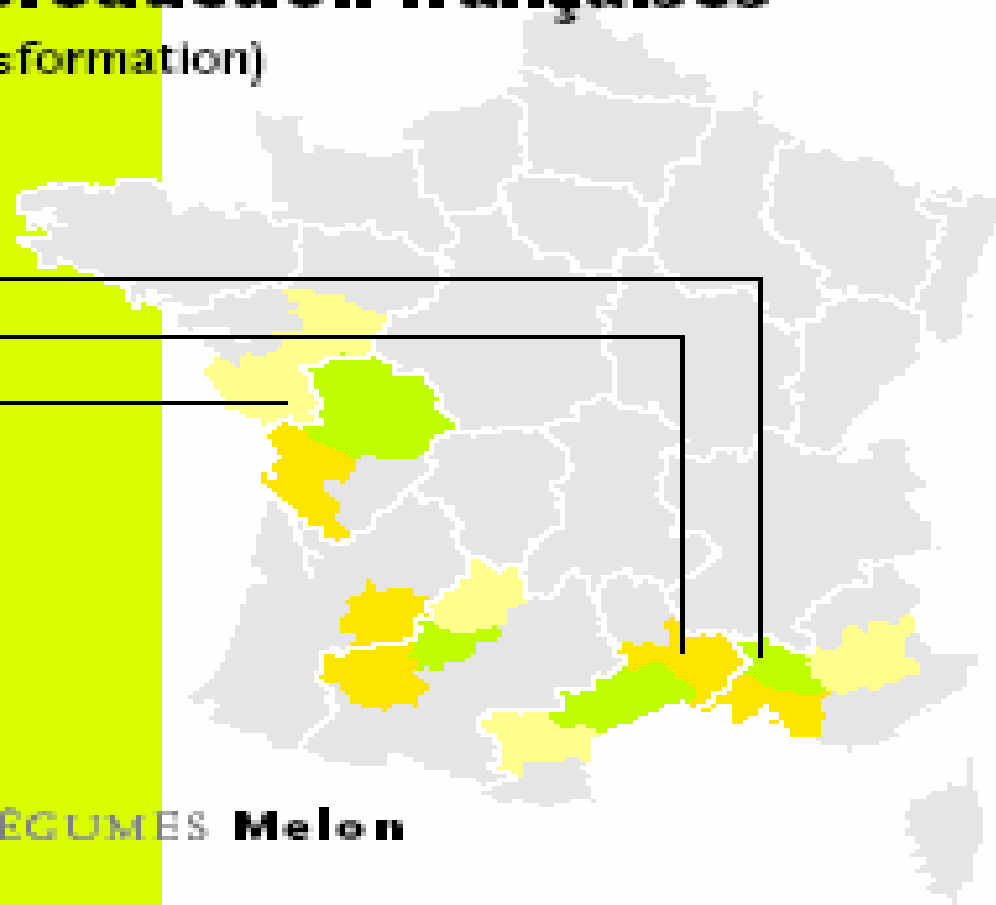
Principales zones de production françaises

(pour le marché du frais et la transformation)

de 27 000 à 40 000 t

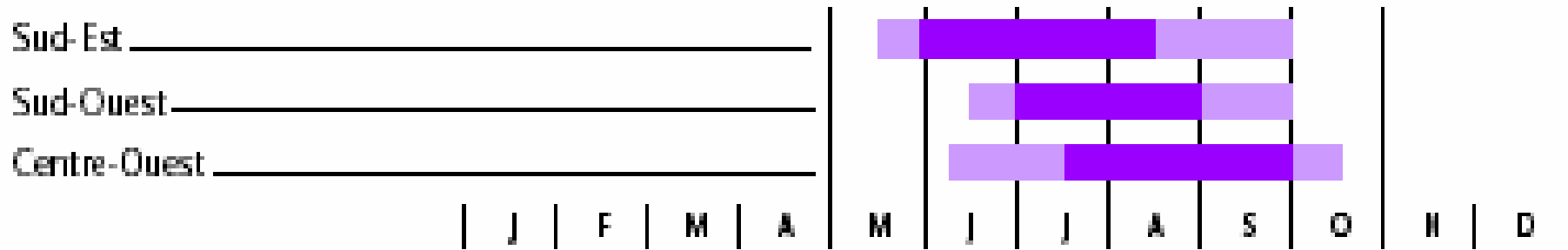
de 12 000 à 22 000 t

de 5 000 à 10 000 t



Production calendar (according to Brossard, 2002).

Southeast – Southwest - Center West

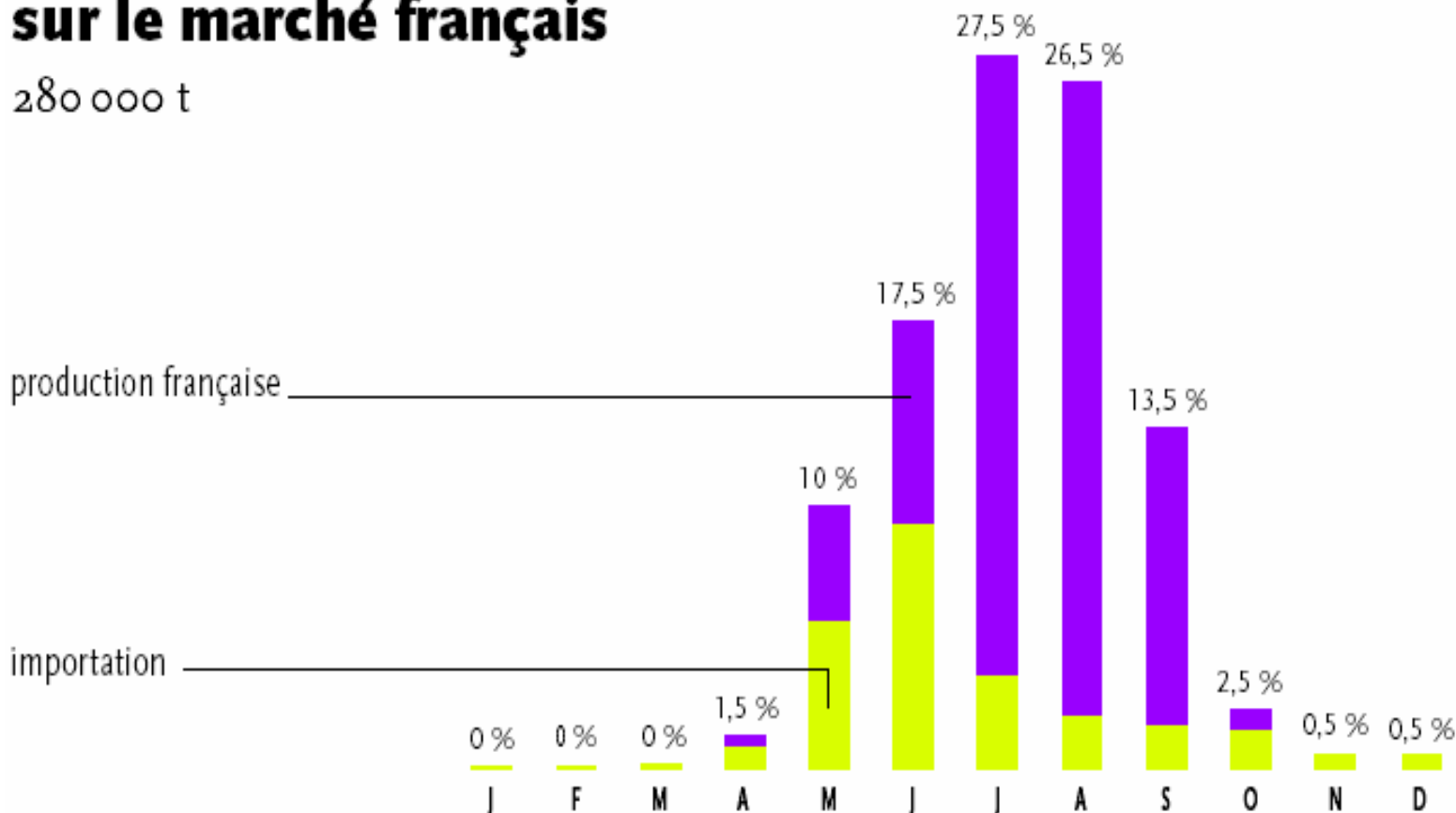


Marketing calendar for the French market (according to Brossard 2002).

French production - Importation

Calendrier de commercialisation sur le marché français

280 000 t



□ Courgettes

Principal zones for French production (for the fresh production market and that for transformation, according to Brossard, 2002).

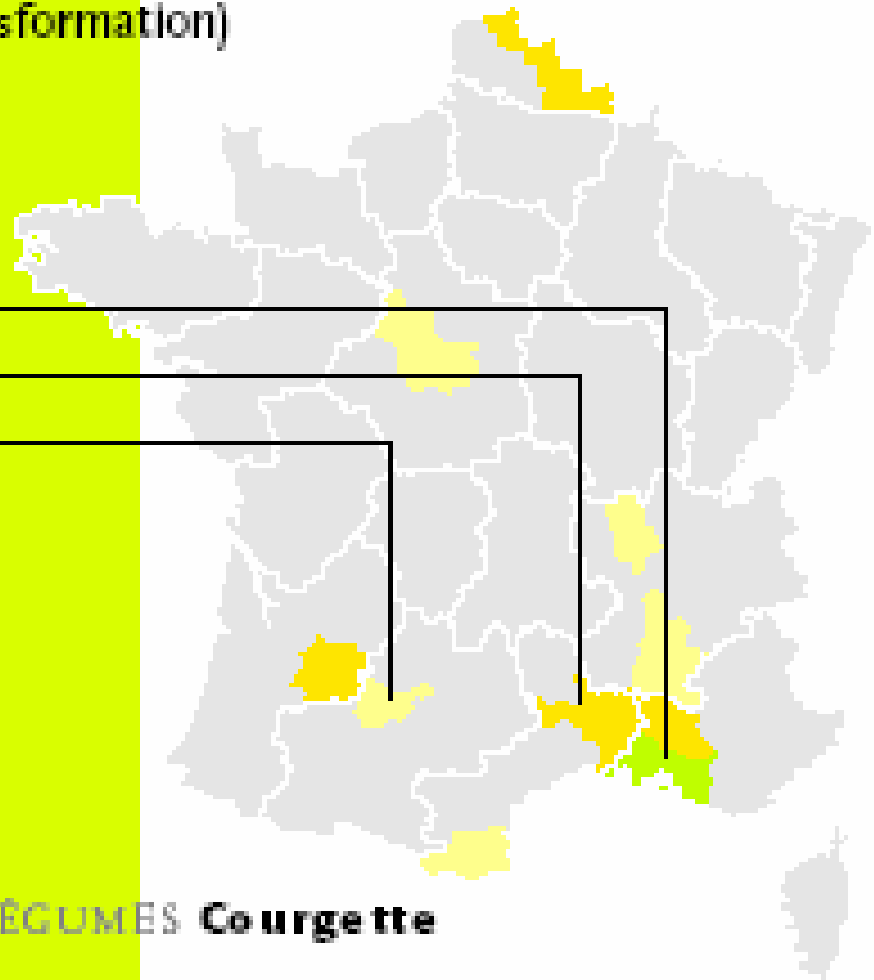
Principales zones de production françaises

(pour le marché du frais et la transformation)

Plus de 65 000 t

de 6 000 à 11 000 t

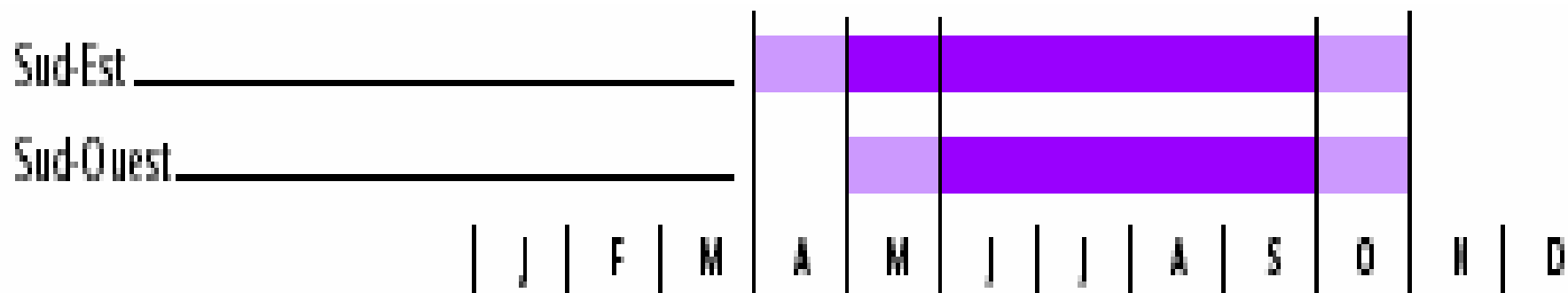
de 2 000 à 4 000 t



Production calendar (according to Brossard, 2002).

Southeast

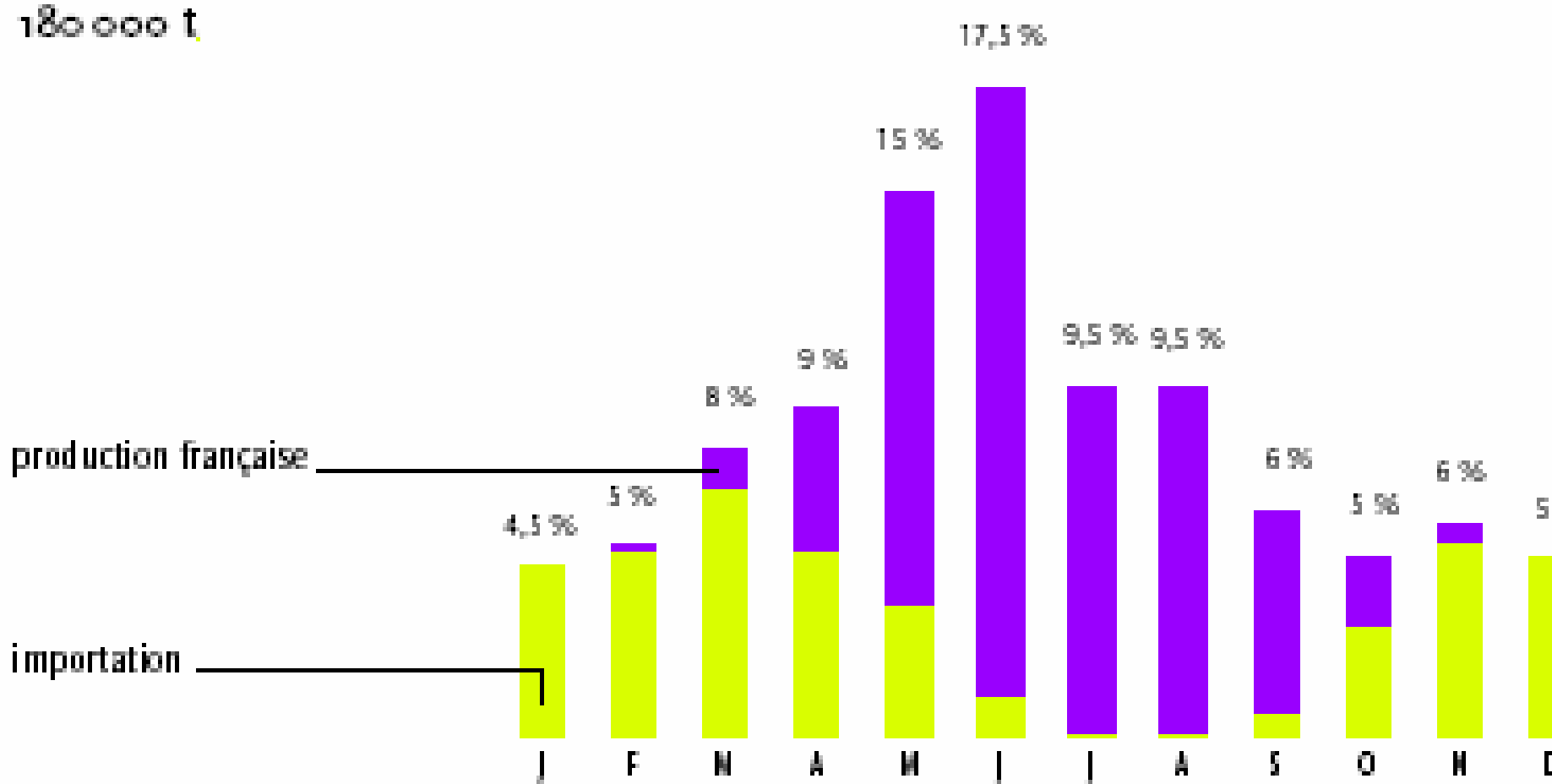
Southwest



Marketing calendar for the French market (according to Brossard 2002).

French production
Importation

180 000 t



2-Methyl bromide use :

2-1 – Pests, diseases, weeds or other problems for which M.B is specifically used

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-Cucumbers	Melons	Courgettes
<i>Phomopsis sclerotioïdes</i>	<i>Fusarium oxysporum</i>	<i>Fusarium solani</i>
<i>Pythium spp</i>	<i>Pythium spp</i>	<i>Fusarium vasculaire</i>
<i>Rhizoctonia solani</i>	<i>Rhizoctonia solani</i>	<i>Sclerotinia sclerotiorum</i>
<i>Fusarium solani</i>	<i>Sclerotinia sclerotiorum</i>	<i>Rhizoctonia solani</i>
<i>Sclerotinia sclerotiorum</i>	<i>Verticillium dahliae</i>	<i>Pythium spp</i>
<i>Meloidogyne javanica</i>	<i>Phomopsis</i>	<i>Meloidogyne javanica</i>
<i>Meloidogyne incognita</i>	<i>Pyrenochaeta</i>	<i>Meloidogyne incognita</i>
<i>Meloidogyne arenaria</i>	<i>Meloidogyne javanica</i>	<i>Meloidogyne arenaria</i>

2-2 - Techniques for minimizing MB emissions

Table 1: The French methyl bromide standards for soil and substrate disinfection

<i>Usage</i>	<i>Registration before 20.2.00</i>	<i>Registration after 20.2.00 *</i>
Nematodes	750 kg/ha	400 kg/ha
All fungi except <i>Pyrenochaeta lycopersici</i> and <i>Phomopsis scleroïdes</i>	750 to 1000 kg/ha	500 kg/ha
<i>Pyrenochaeta lycopersici</i>	1000 kg/ha	600 kg/ha
<i>Phomopsis scleroïdes</i>	1200 kg/ha	750 kg/ha
Substrates	0.6 kg/m ³	0.5 kg/m ³

Chemical disinfection

Cucumbers

	Metam-sodium	Dazomet	Dichloropro-pene	Tetrathiocar-bonate
Technique experimented	yes	yes, but ineffective	yes	yes
Large-scale trial with producers	yes, but very limited efficacy	no	yes, only on the edges, presence of nematodes	no

- **Melons**

	Metam-sodium	Dazomet	Dichloroprop-ene	Tetrathiocar-bonate
Technique experimented	yes	yes	yes	yes
Large-scale trial with producers	yes	yes, very little due to its cost and weak efficacy	yes, in soil contaminated with nematodes	yes, after the failure of first treatment for nematodes (often through a drip system)

- **Courgettes**

	Metam- sodium	Dazomet	Dichloropr opene	Tetrathioc ar-bonate
Large-scale trial with producers	yes	yes	yes, the most widely used	yes

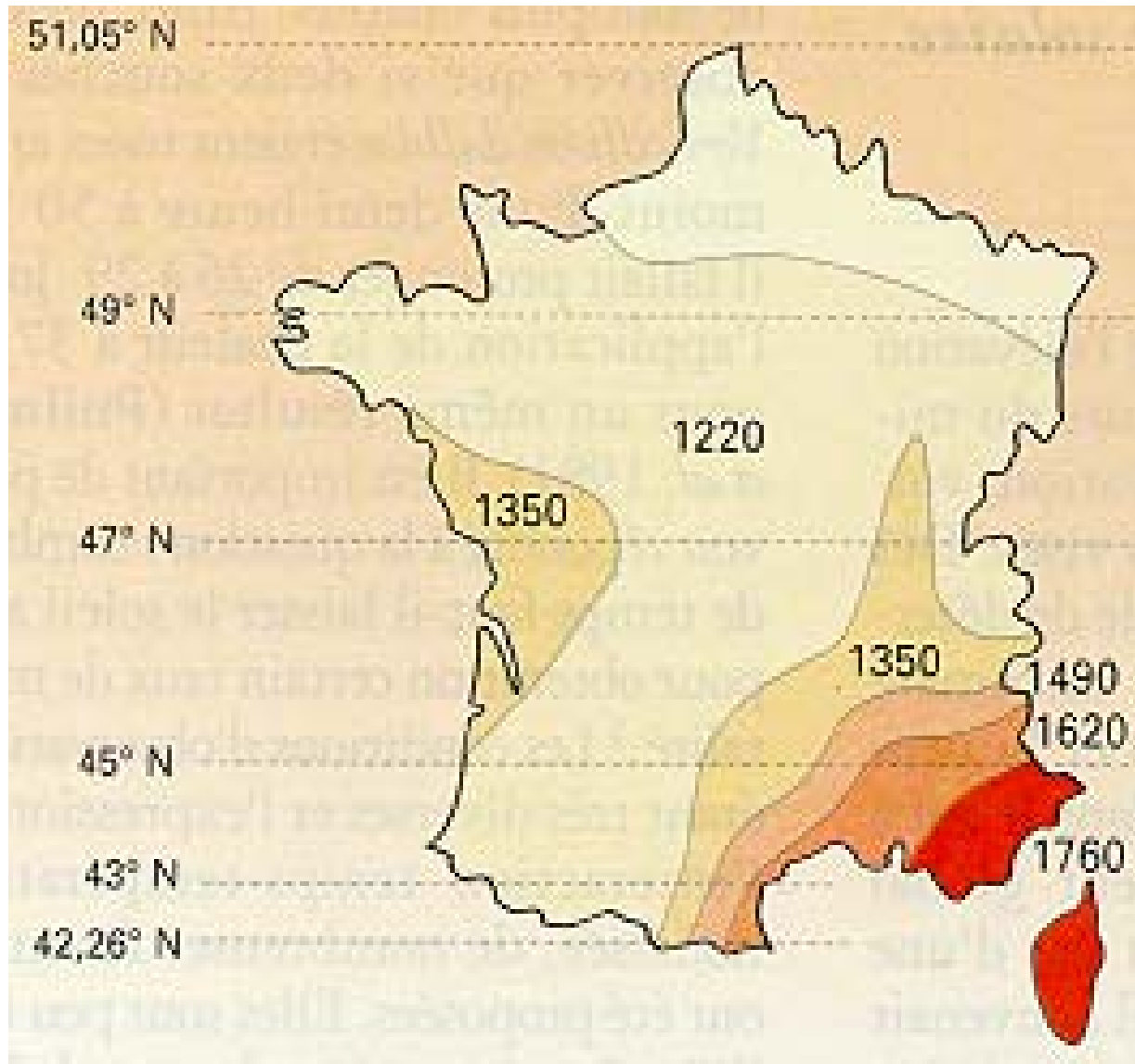
Physical disinfestation :

- Steaming;
- Solarisation;
- Soil biodisinfestation;

Biological alternatives :

- Grafted plants ;
- The utilization of antagonists;
- Utilization of plants which help reduce phytophagous nematode population (research program);
- Soil-less cultivation.

Figure 1: Annual solar rays in kWh/m², according to Foury (1995).



Efficacy of physical and biological alternatives techniques on main Cucurbitaceae soil pathogens

Stea

	R o t a t i o n	<u>Ste</u> <u>am</u> <u>disi</u> <u>nfec</u> <u>ti</u> <u>o</u> <u>n</u>	sola riza tion	bio disi nfe ctio n	Nem ab ci dal plan ts	R esi stan t vari eties	gra ftin g	ant ago nist s	Subs trate cop s
Fuarium solani	*(1)	*	*	?	●	*	●	*	*
Fusarium oxysporum	*	*	●	?	●	● à **	● à **	*	*
Phomopsis sclerotioïdes	*	●	●	?	●	●	●	*	**
Pythium spp	* *	**	**	?	●	● à **	●	*	*
Rhizoctonia solani	* *	** *	**	**	●	●	●	*	**
Sclerotinia sclerotiorum	*	*	*	?	●	●	●	**	**
Verticillium dalhiaie	*	*	*	?	**	●	● à **	*	**
Meloidogyne javanica	*	*	*	?	**	● à **	● à **	*	**
Meloidogyne incognita	*	*	*	?	**	● à **	● à **	*	**
Meloidogyne arenaria	*	*	*	?	**	● à **	● à **	*	**
Meloidogyne hapla	*	*	*	?	**	● à**	●	*	**

1= little knowledge
 *= low efficacy
 **= average efficacy
 ***= good efficacy
 °= ineffective

Cost of application of MeBr and alternatives

	Rate/Ha	Recultivation period	Cost/Ha			
Methyl Bromide	400/ha+ fl	1 week	9.800 €			
Dazomet	700 kg	3 to 4 weeks	5.200 €			
Dazomet+VIF	700 Kg	3 to 4 weeks	7.400 €			
Dichloropropene	160 l	3 to 4 weeks	1.750 €			
Metham sodium	1.200 l	3 to 4 weeks	3.360 €			
Metham sodium + VIF	800 l	3 to 4 weeks	5.400 €			
Tetrathiocarbomate	600 l	2 weeks	2.100 €			
		Alternatives techinques				
Deep steam			10.000 €			
Solarisation	45 days		1	1.070 €		
"Nematocidal" plant	90 days m		1	500 €		
Grafting		8 to 15 days		1.1 €/plantheated greenhouses		
Soilless cutivation				77 / s.m.		

- 1 CUCUMBER COSTS :

<i>Fungi infestations and Alternative</i>	Yield In MT /ha	Cost per year (€/ha)					
		Investment	Fumigation	Plantation irrigation treatments	Cultivation labour	Harvest Labour + packaging	Total (1)
<i>High infestation</i>							
- Methyl bromide	160	6 000	5 000	18 000	12 000	28 000	69 000
Others	133	6 000	2 500	18 000	12 000	23.000	61 500
No treatment	100	6 000	0	18 000	12 000	17.500	53 500
Soil-less	300	20 000	0	71 000	17 000	52 500	160 500
<i>Medium infestation</i>							
Methyl bromide	160	6 000	5 000	18 000	12 000	28 000	69 000
Others	145	6 000	2 500	18 000	12 000	25.500	64 000
No treatment	123	6 000	0	18 000	12 000	21.500	57 500
Soil-less	300	20 000	0	71 000	17 000	52 500	160 500

GROSS AND NET REVENUE / YEAR

Table 2 : Gross and net revenue for cucumber (according to CTIFL 'Centre Technique Inter-Professionnel des Fruits et Légumes 2003 and SNS Service des Nouvelles des Marchés)

	Cost per year 1 (€/ha)		
Alternative	Total (1)	Gross revenue (€/ha) (2)	Net Revenue (€/ha) (3)
		Yield in kg X price (€)	Year
<u>High infestation</u>			
-	69 000	160 000 x 0.6 = 96 000	27 000
Methyl bromide	61 500	133 000 x 0.6 = 80 000	18 500
Others	53 500	100.000 x 0.6 = 60.000	6 .500
No fumigation	160 500	300.000 x 0.6 = 180.000	19 500
Soil-less			
<u>Medium infestation</u>			
-	69 000	160 000 x 0.6 = 96 000	27 000
Methyl bromide	64 000	145 000 x 0.6 = 87 000	23 000
Others	57 500	123.000 x 0.6 = 73 800	16 300
No fumigation	160 500	300;000 x 0.6 = 180.000	19 500
Soil-less			

Exemple :GROSS AND NET REVENUE / YEAR : for 1.5ha crop area**Table 3 : gross and revenue / year for cucumber according to Agriculture centre 66 & CTIFL 'Centre Technique Inter-Professionnel des Fruits et Légumes 2003)**

Alternatives	Net Revenue for last reported year (€/ha) (3)	Crop area (ha) (4)	Net Revenue (€/year) (5)	Other Revenues (€/year) (6)	Global Revenues (€/year) (7)
<i>High infestation</i>					
- Methyl bromide	27 000	1.5	40 500	40 500	81 000
Others	18 500	1.5	27 750	40 500	68 250
No fumigation	6 500	1.5	9 750	40 500	49 500
Soil-less	19 500	1.5	29 250	40 500	69 750
<i>Medium infestation</i>					
- Methyl bromide	27 000	1.5	40 500	40 500	81 000
Others	23 000	1.5	34 500	40 500	74 500
No fumigation	16 300	1.5	24 450	40 500	64 950
Soil-less	19 500	1.5	29 250	40 500	69 750

5-2 Melon cost

<u>Fungi infestations</u> and Alternative	Yield In tonne /ha	Cost per year (€/ha)					
		Investmen t	Fumigatio n	Planta tion irrigation treatments	Cultivati on labour	Harvest Labour	Total (1)
<u>EARLY CROP</u> <u>High infestation</u>							
- Methyl bromide	35	11 000	5 000	23 000	11 200	5 800	56 000
Others	29	11 000	2 500	23 000	11 200	4 800	52 500
No treatment	22	11 000	0	23 000	11 200	3 600	48 800
<u>EARLY CROP</u> <u>Medium infestation</u>							
- Methyl bromide	35	11 000	5 000	23 000	11 200	5 800	56 000
Others	32	11 000	2 500	23 000	11 200	5 200	52 900
No treatment	27	11 000	0	23 000	11 200	4 400	49 600
<u>LATE CROP</u> <u>High infestation</u>							
- Methyl bromide	30	8 500	5 000	12 700	11 000	5 000	42 200
Others	25	8 500	2 500	12 700	11 000	4 100	38 800
No treatment	19	8 500	0	12 700	11 000	3 100	35 300
<u>LATE CROP</u> <u>Medium infestation</u>							
- Methyl bromide	30	8 500	5 000	12 700	11 000	5 000	42 200
Others	27	8 500	2 500	12 700	11 000	4 500	39 200
No treatment	23	8 500	0	12 700	11 000	3 800	36 000

Gross and net revenue

Alternative	Cost per year (€/ha) (1)	Gross revenue (€/ha) (2)	Net Revenue (€/ha) (3)
		Yield in kg X price (€)	Year 1
<u>EARLY CROP</u> <u>High infestation</u>			
-	56000	35 000 x 1.8 = 63 000	7 000
Methyl bromide	52 500	29 000 x 1.8 = 52 200	300
Others	48 800	22 000 x 1.8 = 39 600	- 9 200
No fumigation			
<u>EARLY CROP</u> <u>Medium</u> <u>infestation</u>			
-	51 000 56 000	35 000 x 1.8 = 63 000	7 000
Methyl bromide	48 000 52 900	32 000 x 1.8 = 57 600	4 700
Others	44 800 49 600	27 000 x 1.8 = 48 600	- 1 000
No fumigation			
<u>LATE CROP</u> <u>High infestation</u>			
-	40 000 42 200	30 000 x 1.6 = 48 000	5 800
Methyl bromide	36 800 38 800	25 000 x 1.6 = 40 000	-1 200
Others	33 500 35 300	19 000 x 1.6 = 30 400	- 4 900
No fumigation			
<u>LATE CROP</u> <u>Medium</u> <u>infestation</u>			
-	40 000 42 200	30 000 x 1.6 = 48 000	5 800
Methyl bromide	36 400 39 200	27 000 x 1.6 = 43 200	4 000
Others	34 100 36 000	23 000 x 1.6 = 36 800	800
No fumigation			