SEMARNAT/UNIDO DEMONSTRATIONS ON MB ALTERNATIVES FOR STRAWBERRY IN BAJA CALIFORNIA. 2009 RESULTS.

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In Baja California (Mexico), strawberries are located in San Quintín Valley (33-34 ºN), Southern Ensenada. Annual yield is estimated at 60.000-70.000 tonnes per year for fresh consumption and industry. Most of this production is exported to the United States. A very high percentage of the cultivated area is treated with the mixture 75:25 MB:chloropicrin. The Mexican Government, through the Secretary of Environment and Natural Resources (SEMARNAT), in cooperation with the United Nations Industrial Development Organization (UNIDO), have launched a Pilot Project about demonstrations of alternatives to the MB for strawberry cultivation. Additional data about the strawberry in Baja California, requirements for this Pilot Project and 2008 results were presented in 2008 MBAO Conference (Cotero et al., 2008). Now the results in the second year of demonstrations (2009) are presented. Similar chemical alternatives (Table 1) in the same beds (plots) than 2008 were tested in the same farms in the San Quintín Valley: "Campo Olmos" (Berrymex), Campo José de la Luz "Rancho Don Juanito" and Campo Chichi "Santa Mónica", located in three different towns along the coast (North to South): Colonia Ejido Emiliano Zapata, Colonia Vicente Guerrero and San Quintín, respectively. A new fourth farm, "Rancho San Simón", located in the Southern part of San Quintín Valley, was incorporated to this Pilot Project.

INSTALLATION OF DEMONSTRATIONS AND CROPS.

"Rancho Don Juanito" (Colonia Vicente Guerrero): Alternative fumigants were applied between 5 and 29 of September, 2008. Each demonstration (T1 to T5) tooks 18 beds of 70 m length, mulched with transparent PE film, with 4 rows of plants and density of around 54,000 plants/ha (Table 1). T0, overall fumigation standard in the Farm was MB:chloropicrin 75:25 w/w, 457 lb/ha. The planting date of the variety 'Splendor' (Berry Genetics) was on October 16, 2008. Precedent crops were strawberry after strawberry.

"Campo Olmos" (Berrymex) (Colonia Ejido Emiliano Zapata): This was the second year of strawberry cultivation; previously this plot was no cultivated and covered with the native flora of the region: "vidrillo" (*Batis maritima*) (pickleweed). Alternative fumigants were applied between 18 and 26 of September, 2008. Each demonstration (T1 to T5) tooks 15 beds of 81.89 m

length, mulched with black opaque PE film, with 4 rows of plants and density of around 79,000 plants/ha (Table 1). T0, overall fumigation standard in the Farm was equal to T3 (1,3D:chloropicrin, 500 kg/ha). The planting date of the variety 'Driscoll El Dorado' was on October 8, 2008.

Campo Chichi "Santa Mónica" (Colonia San Quintín): Alternative fumigants were applied between 6 and 17 of September, 2008. Each demonstration (T1 to T5) tooks 15 beds of 91 m length, mulched with black opaque PE film, with 4 rows of plants and density of around 76,000 plants/ha (Table 1). T0, overall fumigation standard in the Farm was equal to T3 (1,3D:chloropicrin, 500 kg/ha). The planting date of the variety 'Splendor' (Berry Genetics) was on October 24, 2008. Precedent crops were strawberry after strawberry.

"Rancho San Simón" (Ejido Sánchez Díaz): Alternative fumigants were applied between 1 and 10 of October, 2008. Each demonstration (T1 to T5) tooks 15 beds of 91 m length, mulched with green opaque PE film, with 4 rows of plants and density of around 76,000 plants/ha (Table 1). T0, overall fumigation standard in the Farm was MB:chloropicrin 67:33 w/w, 457 lb/ha (cv. 'Splendor'). The planting date of the variety 'Virtue' (Berry Genetics) was on October 18, 2008. Precedent crops were vegetables: tomato, onion, brassicae (cabbage, Brussels sprouts), etc. This farm has clay soils while the others are typically sandy soils. In particular, the area of T1 to T5 suffered drainage and high salinity problems.

DEMONSTRATIONS DEVELOPMENT. RECORDED TRAITS

Replanting percentage: It shows the number of dead plants observed in each of the 5 studied beds in every demonstration and Farm. These plants were replaced by new viable plants (replant) a few weeks after the transplant. Replanting percentages were low: always smaller than 5% (plants initially planted), in farms "Rancho Don Juanito" and "Campo Olmos", medium (4-10%) in "Santa Mónica" and very high in "Rancho San Simón" (Table 2).

Weed control: Weed emergence was null or very weak in "Campo Olmos", "Santa Mónica" and "Rancho San Simón". In the case of "Campo Olmos", second year of strawberry cultivation after non cultivated plots, the high concentration of "vidrillo" (*Batis maritima*) (pickleweed) observed during the former season (2008), almost disappeared all along this 2009 cultivation season. However, in the case of "Rancho Don Juanito", example of continued and sustained cultivation of strawberry every year with MB:Pic mixture, emergence of *Malva* spp. was very significant during the first month of the cultivation season. One month after planting date (Nov., 11, 2008), the total number of removed weeds (99% *Malva* spp.) per bed was recorded as biomass removed and time needed for manual uprooting (Table 3). Weed observations in our second year of demonstrations point out that, unlike other areas devoted to strawberries production, weed control is not a key factor in the use of alternatives to MB in the San Quintín Valley (Baja Califonia, Mexico).

Plant vigour: 10 randomly selected plants from each bed were observed throughout the complete growing season. Plant diameter was determined by

taking two measurements of the above ground foliage from each plant. Mid-March and mid-April results are presented (Table 4).

Yield and fruit size: In each collection, weight of marketable fruits per bed was recorded. The harvest (each 2-3 days) began in the early January 2009 and continued until the last days of May 2009. For a fine interpretation of the results, it is important to consider that only absolutely healthy fruits of extra and first commercial category for fresh consumption market (exports to California & USA) were recorded. These values are smaller than the actual yields and should be used just as estimations of potential yields in the demonstrations and do not reflect the current yields of the Farms. In fact, due to the low prices for fresh market in USA, fruits harvested from first of May, 2009 (medium-final stage), had the industry (IQF, purees, etc) ('canería' in Mexican expression) as final destination and were not recorded for this 2009 Pilot Project. On each collection a sample of 20 fruits of extra and first commercial category was randomly selected for fruit size. Results summarized in Table 5 will be presented and discussed.

References

Cotero, M.A., Estrada, J.F., Urbina, S., Nolazco, M.G., Castellá, G., González-Sandoval, C., Hedrick, W., Meza, J. and López-Aranda, J.M. 2008. SEMARNAT/UNIDO Demonstrations on MB Alternatives for Strawberry in Baja California (Mexico). Preliminary results. En: Proc. 2008 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions. November, 2008, Orlando, USA, 66:1-5.

Table 1.- MB alternatives for strawberry. Demonstration fields. Baja California (Mexico). 2008-2009.

Demonstr.	Active ingredient	Trade mark	Rate	Application	Company
T1 (D.Juanito and C.Olmos)	MB:chloropicrin 50:50 w/w	Tri-Con 50/50 EC	400 kg/ha	Broadcast shank-appl.	Trical de Baja California
T1 (S.Mónica and S.Simón)	MB:chloropicrin 50:50 w/w	Tri-Con 50/50 EC	400 kg/ha	Pre-plant drip irrigation	Trical de B. California
T2	Chloropicrin	Tri-clor EC	500 kg/ha	Pre-plant drip irrigation	Trical de B. California
T3	1,3-dichloropropene: chloropicrin	Piclor 35 EC	500 kg/ha	Pre-plant drip irrigation	Trical de B. California
T4	Metam potassium	Busan 69 GE	500 l/ha	Pre-plant drip irrigation	Buckman
T5	Metam sodium	Lucafum 516	1000 l/ha	Pre-plant drip irrigation	Buckman
T0 (D.Juanito)	MB:chloropicrin 75:25 w/w		457 lb/ha	Broadcast shank-appl.	Trical de B. California
T0 (C.Olmos and S.Mónica)	1,3-dichloropropene: chloropicrin	Piclor 35 EC	500 kg/ha	Pre-plant drip irrigation	Trical de B. California
T0: (S.Simón)	MB:chloropicrin 67:33 w/w		457 lb/ha	Broadcast shank-appl.	Trical de B. California
T0: Overall fumigation standard in the Farm.					

Table 2.- Replanting percentage (% of death plants after planting).

	D.Juanito	C.Olmos	S.Monica	S.Simón
Planting date	Oct., 16, 08	Oct., 8, 08	Oct., 9, 08	Oct., 18 08
Replant date	Oct., 27, 08	Nov., 6, 08	Oct., 24, 08	Oct., 29, 08
T1 (MB:Pic 50:50)	1.20 b	1.06 c	6.69 ab	5.46 c
T2 (Pic)	0.86 b	1.60 c	8.03 a	10.76 b
T3 (1,3D:Pic)	0.93 b	1.74 bc	6.50 ab	32.60 a
T4 (MK)	2.48 a	3.03 ab	9.26 a	11.59 b
T5 (MS)	2.61 a	3.28 a	3.71 b	8.39 bc*
T0	2.10 a	1.74 bc	6.50 ab	11.52 b
Means followed by the same letter in each column were not significantly different (0.5≤ P) by the LSD test (transformation arcsin(sqrtX/100)).*T5 (S.Simón): untreated.				

Table 3.- Weed control in "Don Juanito" Farm. *Malva* spp. removed per bed.

Demonstration	Kg of weed removed/bed	Time (minutes)/bed
T0 (MB:Pic 75:25)	7.4 d	24.8 c
T1 (MB:Pic 50:50)	15.7 b	46.6 b
T2 (Pic)	24.1 a	78.8 a
T3 (1,3D:Pic)	12.3 bc	19.0 d
T4 (MK)	8.0 cd	17.0 de
T5 (MS)	6.0 d	13.8 e
*Means followed by the same letter in each column were not significantly different (0.5≤ P) by the LSD test.		

Table 4. Plant vigour: Plant diameter (cm) at mid-season.

	D.Juanito		C.Olmos		S.Monica		S.Simón	
	Mar.,15	Apr.,18	Mar.,15	Apr.,19	Mar.,15	Apr.,18	Mar.,16	Apr.,18
Cultivar:	'Splendor'		'El Dorado'		'Splendor'		'Virtue'	
T1	26.9abc	30.2abc	27.9a	31.8a	27.8a	30.3a	28.5a	31.2ab
T2	28.2ab	30.8ab	27.6ab	28.2b	27.6ab	30.5a	28.3a	31.1ab
T3	28.3a	31.0a	27.2ab	29.6b	27.2ab	29.9a	28.4a	31.5a
T4	26.8bc	29.2cd	26.9b	29.2b	26.9b	29.9a	28.4a	30.8ab
T5	26.3c	28.9d	24.7c	28.2b	24.7c	28.9b	27.2b*	30.0b
T0	27.4abc	29.8bcd	27.2ab	29.6b	27.2ab	29.9a	27.8ab**	30.3ab
Means followed by the same letter in each column were not significantly different (0.5≤ P) by the LSD test.*T5 (S.Simón): untreated.**T0 (S.Simón): cv. 'Splendor'								

Table 5.- Yield and fruit weight (January-April, 2009)

Farm/cv.	Demonstration	Harvest period	Nº of collec-tions	Yield in kg harvested per bed	Averaged fruit weight (g)
D. Juanito	T1 (MB:Pic)	1/9-5/4	49	223.93 c	26.1 a
cv. 'Splendor'	T2 (Pic)			201.62 c	25.7 a
	T3 (1,3D:Pic)			326.60 b	26.7 a
	T4 (MK)			327.46 b	26.7 a
	T5 (MS)			356.25 a	26.7 a
	T0 (MB:Pic)			335.19 ab	26.9 a
C.Olmos	T1 (MB:Pic)	1/15-4/30	43	133.02 b	22.6 a
cv. 'El Dorado'	T2 (Pic)			172.25 a	21.5 a
	T3 (1,3D:Pic)			126.30 c	22.3 a
	T4 (MK)			91.80 d	22.4 a
	T5 (MS)			64.93 e	22.2 a
	T0 (1,3D:Pic)			126.30 c	22.3 a
S.Monica	T1 (MB:Pic)	1/12-4/28	39	1050.3 a	26.2 a
cv. 'Splendor'	T2 (Pic)			1019.0 b	25.8 a
	T3 (1,3D:Pic)			1043.0 a	25.9 a
	T4 (MK)			1022.5 b	25.5 a
	T5 (MS)			1029.3 b	25.5 a
	T0 (1,3D:Pic)			1043.0 a	25.9 a
S.Simón	T1 (MB:Pic)	1/16-5/6	56	85.17 d	22.3 b
cv. 'Virtue'	T2 (Pic)			76.44 e	21.8 b
	T3 (1,3D:Pic)			97.41 b	21.6 b
	T4 (MK)			65.28 f	21.7 b
	T5 (untreated)			91.07 c	21.0 b
cv. 'Splendor'	T0 (MB:Pic)			683.92 a	24.5 a
Means followed by the same letter in each column and Farm were not significantly different ($0.5 \leq P$) by the LSD test.					