

# Technological characterization of Lebanese bread wheat new cultivars under a significant water stress

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- Wheat is cultivated in the Beqaa valley, north and south of Lebanon
- Lebanon annual production of wheat is about 70 000 tons of which 80% durum (Lebanese agricultural institute, 2016).
- Commonly the cultivated wheat is **Durum**
- Lebanon annual importation bread wheat in 2013 was about 603000 tons (FAO, 2017)



Preparation of Lebanese bread

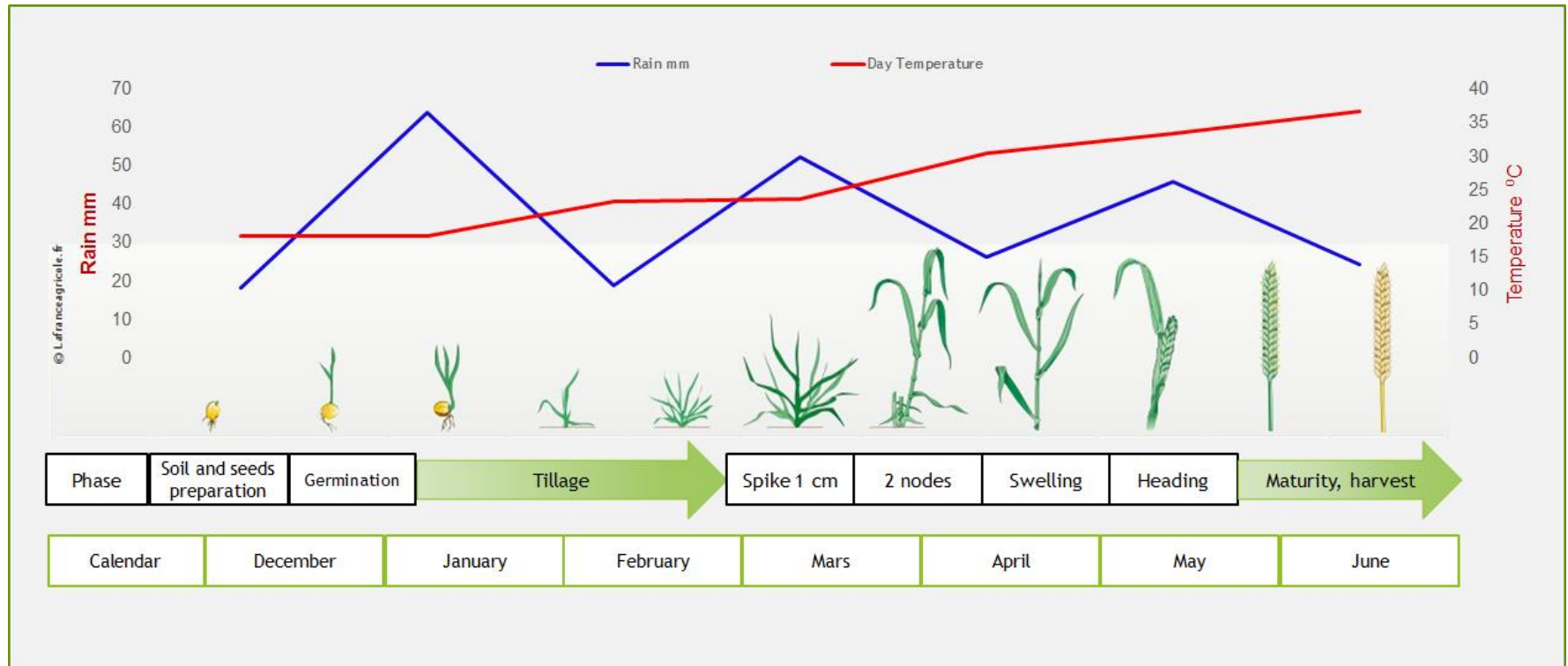


Lebanon imports bread wheat

Wheat flour specifications for Lebanese bread preparation	Values
Wheat proteins (%)	11.5-12.0
Flour Wet Gluten (%)	24-25
Flour Dry Gluten (%)	9-10
Dough baking strength (W) ( $\times 10^{-4}$ joules)	180-200
P/L	1.0-1.1
Absorption (%)	56-57
Stability (min)	6-7
Weakening 12 min (BU)	60-70
Maximum Resistance (BU)	500-600
Extensibility (mm)	110-120



## Climatic changes: **low annual precipitations, low production, need of irrigation**



Optimal conditions of wheat culture: 450-650mm of precipitations for a maximal production of 4.5T/ha,  $T^{\circ} < 25^{\circ}\text{C}$  till swelling phase (IRAL, 2014).

Lebanese agriculture strategies



**Introduction of new bread wheat varieties resistant/tolerant to drought**

Lebanese agriculture research institute (LARI):

- **Settle the national market needs**
- **Introduction of new bread wheat varieties**
- **Varieties adapted to climatic conditions**



# Objectives

- Agronomical and physicochemical characterization
- Rheological and the technological behavior study

## Materials and methods

### Plant material

Sham 8  
MR 1009  
Tal Amara 2  
Katila  
ACSAD 1133

### Agronomic parameters

Yield Crop  
1000 Kernels weight  
Specific weight  
Nb of stems/m<sup>2</sup>  
Nb of spikes/m<sup>2</sup>

### Technological properties

Alveograph  
Farinograph  
Extensograph  
Amylograph



## Agro-climatic Conditions

Harvest 2016				
Month	Rain (mm)	Temperature mean (°C)	Minimum Temperature (°C)	Maximum temperature (°C)
December 2015	18.4	6.3	-0.4	18.2
January 2016	64.0	4.6	-9.4	18.2
February 2016	18.8	9.4	-2.5	23.3
March 2016	52.4	10.7	-0.4	23.7
April 2016	26.4	15.6	0.0	30.4
May 2016	45.8	17.1	0.0	33.4
June 2016	24.4	22.3	6.0	36.7
<b>Total</b>	<b>250.2</b>			

## Agronomic Results

Parameters	Wheat Cultivars					P
	Sham 8	MR 1009	Tal Amara 2	Katila	ACSAD 1133	
Spikelets/spike	38.67	37.33	38.67	40.67	40.00	0.841
Grains/spike	57.67	45.33	53.33	53.33	49.67	0.372
Nb of stems/plant	3.67	3.67	3.67	3.33	2.33	0.638
Nb of spikes/plant	2.67	2.67	2.67	2.33	1.00	0.480
Yield of straw Kg/m <sup>2</sup>	1.37	1.05	1.03	0.87	0.81	0.030
Yield of Grains g/m <sup>2</sup>	168.67	135.33	185.00	112.67	38.00	0.009
Stem length (cm)	74.33	72.00	80.33	70.33	82.67	0.031
Spike length (cm)	9.67	10.33	10.00	8.33	10.67	0.285
Nb of stems/m <sup>2</sup>	809.33	682.67	453.33	454.67	408.00	0.002
Nb of spikes/m <sup>2</sup>	633.33	565.33	352.00	353.33	265.33	0.003

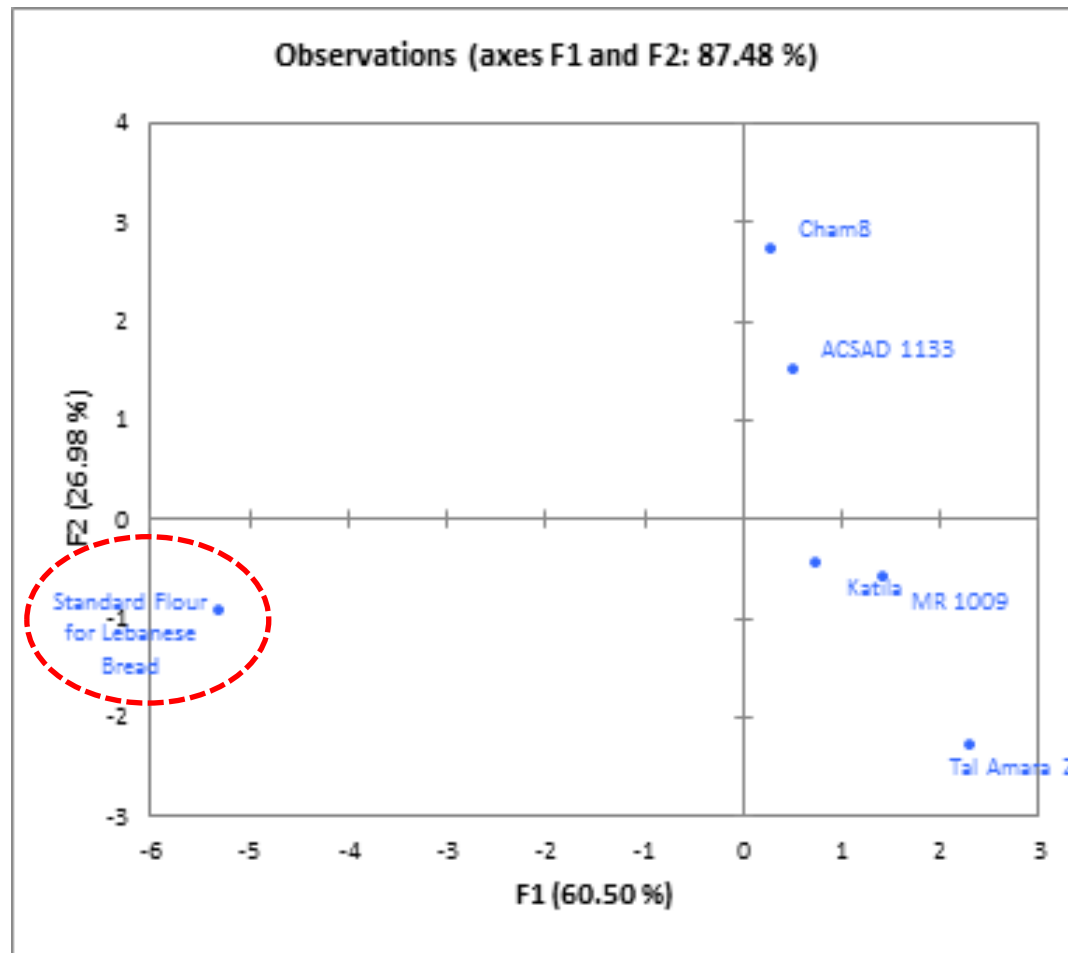
## Physicochemical Results

Parameters	Wheat cultivars					P
	Sham 8	MR 1009	Tal Amara 2	Katila	ASCAD 1133	
Specific weight (Kg/hl)	75.23	73.93	71.03	72.90	74.77	0.001
Weight of 1000 Kernels (g)	23.10	23.78	26.33	26.20	27.13	0.013
Total proteins (%)	19.57	20.24	20.98	20.02	20.60	0.032
Ash (%)	2.07	2.12	2.17	2.05	2.09	0.403
Moisture (%)	9.05	9.31	9.61	9.40	9.97	0.847
Zeleny (Sedimentation)	54.33	57.00	69.00	62.33	61.33	0.005
Falling number (sec)	429.33	449.67	426.33	508.33	438.00	0.103
Wet gluten (%)	48.33	48.57	49.90	47.73	50.33	0.346
Dry gluten (%)	14.43	14.70	14.53	13.73	15.20	0.004
Gluten index	47.33	48.00	50.67	50.00	48.00	0.914
Milling yield (%)	68.89	69.13	60.40	68.76	67.99	0.000

## Rheological Results

Rheological Parameters		Wheat Cultivars					P
		Sham 8	MR 1009	Tal Amara 2	Katila	Acsad 1133	
Farinograph	Absorption (%)	68.2	67.1	62.3	67.3	65.7	0.002
	Development (min)	8.5	12.8	16.6	12.3	9.2	0.413
	Stability (min)	7.4	17.0	19.4	13.9	10.0	0.024
	Weakening 12 min (BU)	91.3	56.7	53.0	61.7	86.0	0.320
Extensograph	Maximum Resistance (BU)	249.3	343.0	347.0	404.3	345.7	0.204
	Resistance to extension (BU)	213.3	269.7	237.3	313.3	279.7	0.162
	Extensibility (mm)	160.7	172.0	210.3	157.3	150.7	0.001
	Coefficient	1.4	1.5	1.1	2.0	1.9	0.030
	Energy (cm <sup>2</sup> )	57.7	83.0	105.3	90.0	75.0	0.060
Alveograph	Dough baking strength (W) (x 10 <sup>-4</sup> J)	200.0	241.3	241.3	281.3	215.0	0.085
	P (mm)	86.0	84.7	57.0	95.7	78.3	0.000
	L (mm)	84.3	109.0	152.7	100.7	95.0	0.013
	P/L	1.0	0.8	0.4	1.0	0.8	0.006
Amylograph	Beginning of gelatinization (°C)	59.7	60.0	60.9	59.3	60.5	0.000
	Gelatinization temperature (°C)	92.9	93.4	93.9	92.9	92.2	0.029
	Gelatinization max (AU)	1096.0	1233.7	1703.7	1557.3	1478.7	0.002

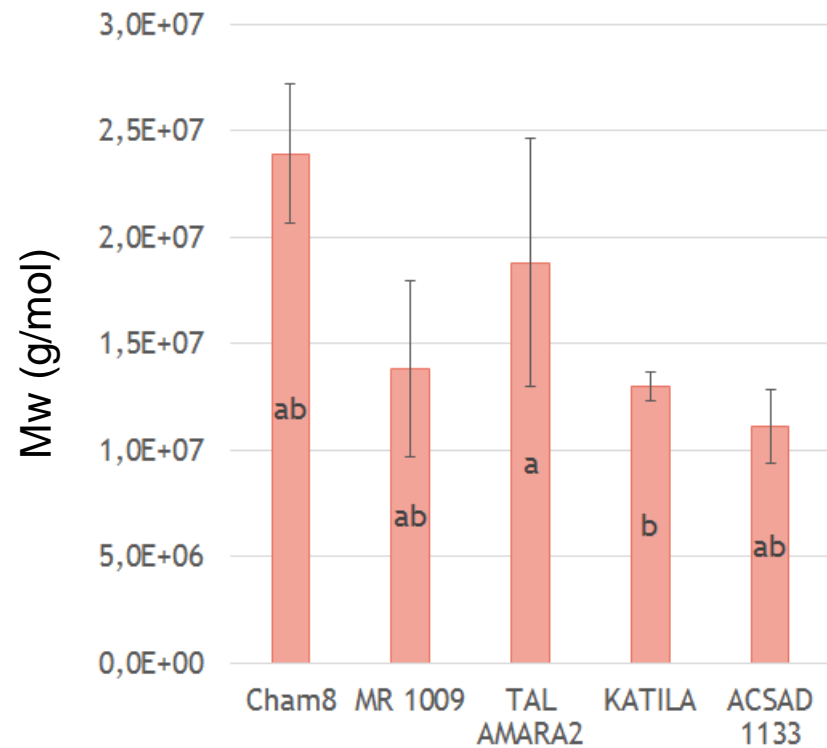
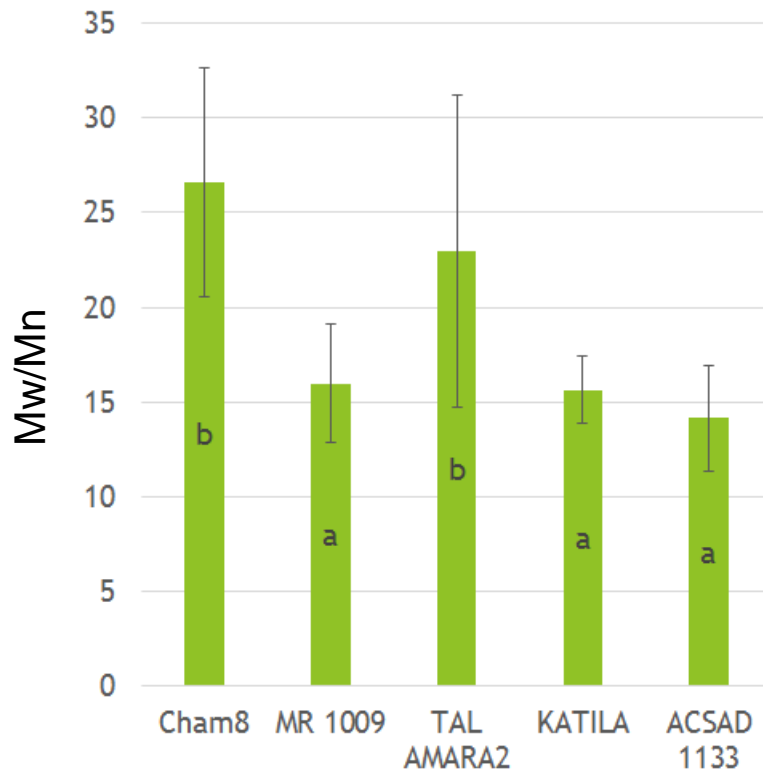
## Comparison with a standard wheat flour



## Conclusions and Perspectives

- The physicochemical properties are greatly affected by abiotic stress (i.e. temperature and/or relative humidity)
- In a first analytical approach, we demonstrated that MWD (i.e. Mw and Mn) of glutenins was significantly affected,

## Conclusions and Perspectives



Glutenin Mw of conventional bread wheat genotypes ranges between 2.0E+07 and 5.0E+07 g/mol.

## Conclusions and Perspectives

- The physicochemical properties are greatly affected by abiotic stress (i.e. temperature and/or relative humidity)
- In a first analytical approach, we demonstrated that MWD (i.e. Mw and Mn) of glutenins was significantly affected,
- These varieties can't be used for Lebanese bread preparation
- Lebanese new strategy :
  - Increasing cultivated surfaces of bread wheat
  - Adopt irrigation

