Factors affecting the dehulling ability in Sunflower.

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Abstract:

In order to improve the quality of sunflower meal, it had been shown that a great benefit could be obtain when the crude fibre content of sunflower seeds was reduce before crushing. Fluctuations in the deshulling ability were then studied. If the cultivar effect is one of the most important factors, the technical pathways are also responsible of these variations. According to the results obtained on the lignification of the hull, it appeared that the better the maturity of the hull, the higher the dehulling ratio is. All factors that can modify the lignification of the hull during the ripening period will explain these variations. If irrigation leads to delay maturity, the dehulling index in this case will decrease compared to the non-irrigated plot. In such case, by waiting the physiological maturity before harvest, the 1000-seed weight will be increase and the dehulling ratio improved. The stability of some cultivars behavior is also demonstrated (for their bad or good dehulling index). This observation led us to suppose that cultivars could be selected on this caracter. This is done by others partners of the research carried out through the E.E.C. dehulling program.

INTRODUCTION

One of the most important factors affecting meal quality of sunflower is the proportion of crude fibre. When a dehulling process is realize prior crushing, meal quality is still to be improve for crude fibre content as a consequence of the remainders of seed hull left over. Dehulling ability of sunflower seed has been observed to vary according with cultivar and location considered. In order to explain such a variation, a research project has been implemented and submitted to the E.E.C. (DG XII; Project N° AGRE-CT90-0029). This project consists in an international trial network, complemented by genetic studies and physiological approaches mainly aimed to find out the relationship between dehulling ability and hull structure. The mains results are presented by Beauguillaume (1991).

MATERIAL AND METHODS

The results presented here bear upon a trial network carried out over 3 years (1989/90/91) in France and 2 years (1990/91) in Spain and in Italy. The mains characteristics of this network are summarized in Table 1. Sunflower cultivars were selected in base to previous results and showed a wide range of variation for dehulling ability. In France, over the 3 years, two water status and two nitrogen levels were compared. In Spain, comparition bear upon irrigation versus non irrigation in 1990/1991 and two nitrogen levels were considered in 1991. In Italy, high water availability was studied in 1990. Next year, by applying irrigation, low and high water status was compared, including this study two levels of nitrogen (Table 1).

Trials were arranged and managed in accordance with the usual practices in each country and/or region. Due to the fact that correlation between the % of mechanical hull (A1) and the dehulling index (T) is submit to fluctuations (r=0.50), real hull content (A6) was monitored in as many samples as possible.

Informations about soil and climate characteristics was recorded. At harwest, 2 seed samples of each experimental plot were taken, one for undergoing a test of mecanical dehullingand a second one for standard laboratory seed analysis (CETIOM, 1987). Dehulling ability index (T) was defined as a ratio (in %) between the proportion of hull, mechanically extracted (A1) and the actual proportion of seed hull (A6). The actual hull seed content of the tested cultivars is shown in Table 2.

Albéna	Euroflor	Flamme	Frankasol	IBH	Viki	Oscar	Florasol
23,6	24,2	25,9	28,9	27,6	24,5	30,9	31,4

Table 2: Mean hull content (A6) of the tested cultivars

Being seed moisture at harvest an important factor influencing dehulling (CARRE, 1989, seed samples were slowly dried down to 8 and 10 % humidity. Seed moisture was also considered as a studied variable in 1991, and two harvest dates were considered in trials: Date 1, when all cultivars reached their own physiological maturity, and Date 2, harvesting at Oscar or Viki maturity.

RESULTS

a. Genotype effect:

Mean dehulling index for each cultivar, year and country averaged over location, nitrogen and water levels is presented in Table 3. There seems to be a general stability for cultivars through years and countries.

Frankasol and Oscar show the highest dehulling index, while Viki and Florasol show the lowest ones. The other cultivars present an intermediate range of figures. It is interesting to notice the extremely high dehulling index obtained in Italy in 1991 which could be related with the applied treatments. The quick kinetic of seed water loss during maturity seems to be related to such a behavior.

Table 3: Mean dehulling index (%) of the tested cultivars

Country	Year	Florasol	Viki	Euroflor	Flamme	Albena	Oscar	Frankasol
France	1989	-	30,2	43,8	59,8	74,4	-	67,8
	1990	-	26,9	42,6	54,8	76,2	-	62,9
	1991	21	25,7	48,3	-	-	47,6	48,7
Spain	1990	-	45	72	-	-	-	75
	1991	48	50	57	-	-	77	72
Italy	1990	-	42	69	-	-	-	74
	1991	80	74	84	-	-	82	88

b. Effect of water availability level:

Data corresponding to the trials carried out to study the effect of different levels of available water on the dehulling index are presented in Table 4.

Except in France in 1990, high water availability improves dehulling index; however, there seems to be interaction between genotype and water status. Being Oscar and Frankasol the cultivars presenting the most changing patterns. Dehulling index in Italy in 1991 show extremely high values, althought treatments with higher levels of water always outscore the low water ones.

Table 7: Correlation coefficient between the % of mecanical hull (AI) and seed characteristics (for all treatments)

	France		Spain		Italy	
	1990	1991	1990	1991	1990	1991
1000-seed weight	0,26	0,53	0,36	-	0,27	0,29
Oil content	-0,69	-0,46	-	-	-0,71	-0,51

On the other hand, seed oil content seems to be negatively correlated with dehulling ability. That could be and explaination for the genetic effect. For example, in avarage, the 1000-seeds weight of Viki (30 g/1000 seeds) is lower than Frankasol one (50 g/1000 seeds). On the opposite, the oil content is in average greater for Viki (up to 55%) than for Frankasol (around 48%).

DISCUSSION - CONCLUSIONS

Cultivar effect seems to be the most important factor influencing sunflower dehulling ability. In those cultivars presenting extreme values for this index, it seems to be highly and positively correlated with seed size and negatively correlated with seed oil content. Cultivar effect might interact with the status of water availability, as in some cases water stress could hasten maturity, influencing the dehulling ability of the seed as well as seed size and seed oil content. The effect of seed characeristics (weight, lenght, density) on the dehulling ratio had been described by DEDIO and DORREL (1989). They concluded that the longer and bigger seeds was easier to dehull, compared to the small ones.

If water status is high at maturity, as in the case of an irrigated crop, hulling index and seed size could increase, if harvest is to be carried out to early (high seed moisture at harvest), this positive trend could be reversed and dehulling index might decrease.

Beauguillaume (1991) presented results that pointed out the importance of the size and shape of hull cells on the ability of the seed to dehull. These characteristics might be, accordingly with our results, highly regulated by the genotype of the cultivar, although it has also been shown that environment (water, nitrogen, date of harvest, etc) could also influence and interact with genotype effect. This interaction seems to be of a higher magnitude in some cultivars (Oscar, Florasol), but in other cases does not seem to be of such a high importance, which lead us to believe that cultivars could be bred bearing a reasonable stability for dehulling ability, through years and locations.

Table 1 - Mains characteristics of the trial network

	FRANCE			SPAIN		ITALY	
	1989	1990	1991	1990	1991	1990	1991
Location	(department) Marne Indre Charente Lot et Garonne	Marne Indre Charente Lot et Garonne	Marne Indre Charente	Cordoba	Cordoba Sevilla	Pisa	Pisa
Cultivars	- Frankasol Viki Euroflor - Albena Flamme	- Frankasol Viki Euroflor - Albena Flamme	Florasol Frankasol Viki Euroflor Oscar - -	Florasol Frankasol Viki Euroflor Oscar - -	Florasol Frankasol Viki Euroflor Oscar - -	Florasol Frankasol Viki Euroflor Oscar - -	Florasol Frankasol Viki Euroflor Oscar - -
Water status	Low : water avaibility < 280 mm (soil contribution + rainfall + Irrigation) High : water avaibility > 280 mm			Non irrigated Irrigated	Non irrigated Irrigated	- High water avaibility (superf. water layer)	Low water avaibility (270 mm) High water avaibility (470 mm)
Nitrogen status	Low : N soil + N fertilizers < 150 kg/ha High: N soil + N fertilizers > 150 kg/ha			-	Low : N soil High: N soil + 100 kg/ha N	-	Low : N soil + 45 kg/ha N High: N soil + 245 kg/ha N

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