

RESULTS REGARDING NEW SUNFLOWER GENOTYPES RESISTANT TO HERBICIDES, OBTAINED AT NARDI FUNDULEA

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Abstract

The purpose of effective weed management is the inclusion of the best measures and strategies to make sustainable sunflower production, and unfavourable for weeds. Application of pre-emergent herbicides and using herbicides tolerant sunflowers will give a good protection for this crop.

Introduction of imidazolinone and tribenuron-tolerant sunflower hybrids in practice is a revolutionary advancement in sunflower production.

*Using the sources of genes for resistance to herbicides for transferring this characteristics into valuable inbred lines there have been obtained high tolerant sunflower genotypes, after many generations of selection. Resistant sunflower hybrids, with high seed yield potential, as well as with high oil content have been released. Such hybrids are very well protected of the broomrape (*Orobanche cumana*), due to the imidazolinone herbicides control on this parasite.*

New sunflower inbred lines having the new gene, CLHA Plus have been obtained. The new hybrids which can be used in CLEARFIELD Plus system will be better protected of weeds, also of broomrape parasite.

Key words: sunflower, resistance, herbicides, lines, hybrids.

INTRODUCTION

Weeds continue to pose a huge challenge for the sustainable production of sunflower despite decades of implementation of contemporary methods in order of their control.

Identification of sunflower resistance to herbicides, in the wild sunflower *H. annuus* (Al Khatib, 1998; Miller, 2000) it was like a revolution in cultivation of this crop. After launch in 2003, Clearfield production system has been well adopted in sunflower growing countries, due to a wide spectrum of weeds and broomrape (*Orobanche cumana*) control, a high level of consistency, flexibility in the timing of herbicides application, season - long

weed control and a low rate of herbicide application (Malizda et al., 2000; 2003; 2012; Zollinger, 2004; Nagy et al., 2006; Phening et al., 2008; Kukorelli et al., 2011; Kaya et al., 2012; 2013). It is expected that the combination of improved imidazolinone formulation in new Clearfield Plus production system will provide a more efficient and reliable weed control in sunflower, including more freedom in crop rotation (Sala et al., 2012; Phening et al., 2012; Weston et al., 2012). Tribenuron-methyl contributes to weed control in sunflower by controlling annual broadleaf weeds and the perennial *Cirsium arvense* post-emergence, increasing the range of available herbicides in sunflower, increasing no-till/conservation

tillage process (Jocic et al., 2008; Bozic et al., 2012).

Sunflower hybrids tolerant to ALS-inhibiting herbicides are useful in controlling *Ambrosia artemisiifolia*, even some authors reported that this weed started to become resistant in some part of the world (Heap, 2016).

MATERIALS AND METHODS

For obtaining inbred lines, having good resistance to herbicides, imidazolinone or sulfonyleurea types, there have been used the genes IMISUN (aditiv: *Imr1* and *Imr2*). For this type of resistance, the sources have been named, HA 442 and RHA 443. For resistance

to tribenuron-methyl there have been used SURES 1 and SURES 2.

For obtaining inbred lines having resistance controlled by CLHA Plus gene, we used the sources BTI-M1 and BTI-R1.

To accelerate the process of selection for resistance it has been used the Protocol for molecular diagnosis, PCR method, for IMISUN genes and CLHA Plus gene.

We introduced in the process of genes transferring, the best inbred lines from our collection, having good agronomic traits.

It has been used a scheme for transferring the characteristics of resistance, presented in Figure 1. The number of generations of selection is higher, comparing with transferring another characteristics.

Elite inbred line (recurrent line) x Source of resistance

irir IRIRF1 x Recurrent line

F1BC1 x Recurrent line

IRir irir

F1BC2 x Recurrent line

IRiririr

F1BC3 x Recurrent line

IRiririr

F1BC4 x Recurrent line

IRiririr

F1BC5 x Recurrent line

IRiririr

F1BC6 x Recurrent line

IRir irir

F1BC6

IRir

Selfpollination (F2BC6–F5BC6) – Homozygous IRIR

Figure 1. Scheme of genes transferring for resistance to herbicides

RESULTS AND DISCUSSIONS

In Table 1 there are presented the lines which have been introduced in process of transferring genes for resistance to imidazolinone herbicides (IMISUN and CLHA Plus), also genes for resistance to sulfonyleurea herbicides (SURES 1 and SURES 2). There are CMS lines, also restorer lines. The same line can

have three variants: resistance to IMI or to SU or CL Plus.

Having ready lines resistant to herbicides we released hybrids resistant to imidazolinone or sulfonyleurea herbicides. In Figure 2 there are presented the results regarding the seed yield, obtained for some of these hybrids, in demo plots, in two locations: Fundulea and Brăila, in year 2018.

Table 1. Sunflower inbred lines introduced in the process of genes for resistance to herbicides transferring

No.	Line	Gene of resistance	Line type
1.	LC 1093	IMI; SU; CL Plus	CMS
2.	LC-1029	IMI; SU; CL Plus	CMS
3.	LC 1004	IMI; SU; CL Plus	CMS
4.	LC 1019	IMI; SU; CL Plus	CMS
5.	LC 991	IMI; SU; CL Plus	CMS
6.	LC 1050	IMI; SU	CMS
7.	AC - 1402	IMI; SU	CMS
8.	AC - 1421	IMI; SU	CMS
9.	AC - 1445	IMI; SU	CMS
10.	AC - 1532	IMI	CMS
11.	LC 1066	IMI; SU; CL Plus	Rest.
12.	LC 1085	IMI; SU; CL Plus	Rest.
13.	LC 1095	IMI; SU; CL Plus	Rest.
14.	LC 1103	IMI; SU; CL Plus	Rest.
15.	Rf - 642	IMI	Rest.
16.	Rf - 687	IMI	Rest.
17.	Rf - 693	SU	Rest.
18.	Rf - 699	SU	Rest.
19.	Rf - 714	IMI; SU; CL Plus	Rest.
20.	Rf - 734	IMI; SU; CL Plus	Rest.

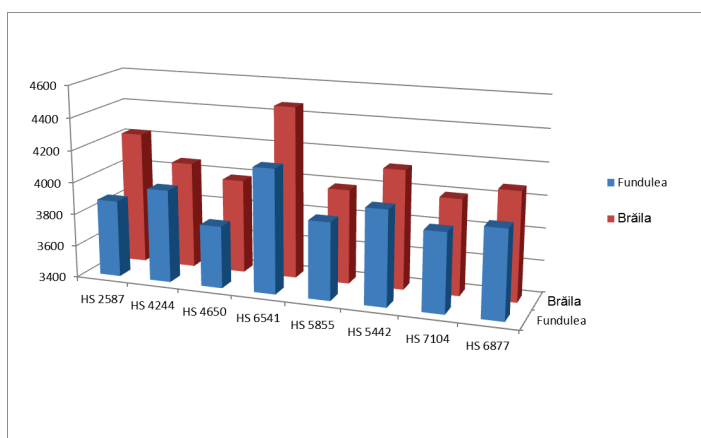


Figure 2. Seed yield (kg/ha) for sunflower hybrids

The hybrids have good seed yield in both locations, taking into consideration among the genetic potential of these, also the climatic conditions in this year. In year 2018 (Figures 3

and 4) the air temperature was good for sunflower, especially in flowering time, also the precipitation amount was favorable to this crop, in June and July.

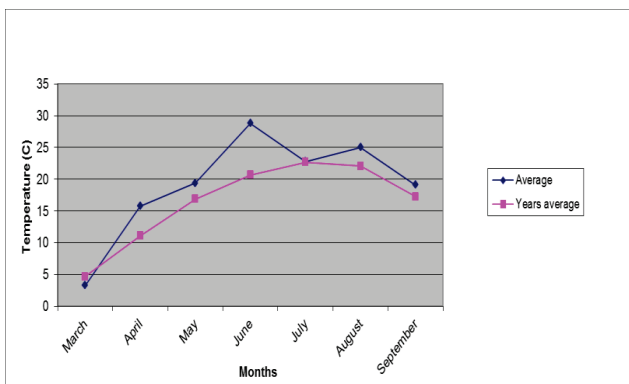


Figure 3. Temperature air in sunflower vegetation, 2018 year

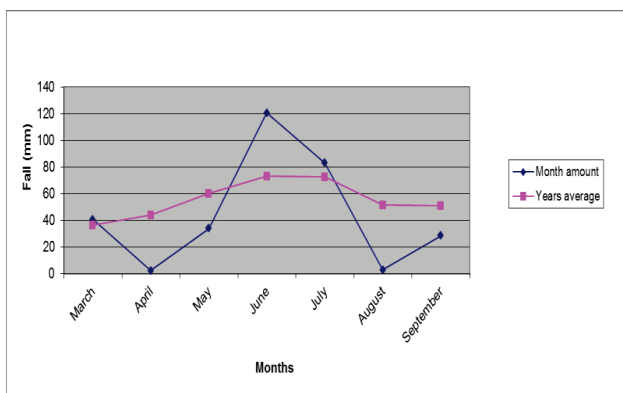


Figure 4. Fall amount in sunflower vegetation, 2018 year

In Figure 5 there are presented the results regarding the oil content of the hybrids. All of

them have more than 50% oil content, in both locations.

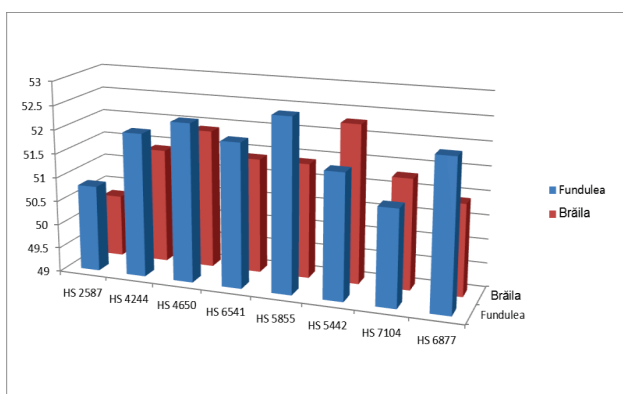


Figure 5. Oil content for sunflower hybrids

In Table 2 are presented the results regarding some important characteristics of the new obtained hybrids. All of them have a quite short vegetation period, they are a medium plant

height, good head diameter, good hectolitic weight, high thousand kernels weight, and also a good tolerance to drought.

Table 2. Important characteristics of the new hybrids

Hybrid	Vegetation period (days)	Plant height (cm)	Head diameter (cm)	Hectolitic weight (kg/hl)	TKW (g)	Resistance to drought (notes)
HS 2587	118	164	25	41.4	74	3
HS 4244	125	167	23	38.2	65	2
HS 4650	124	169	24	38.3	70	2
HS 6541	119	165	24	39.1	73	3
HS 5855	125	168	25	41.2	73	2

Resistance to drought: 1 - resistant; 9 - sensitive.

CONCLUSIONS

In the breeding program for sunflower, at NARDI Fundulea, there have been obtained valuable inbred lines, having good resistance to herbicides. There have been used sources for resistance received on the base of contracts with companies which produced them.

By combination of these lines, CMS with Restorer we received good hybrids, which have been tested in demonstration plots.

The hybrids released very good seed yield, also they have very good oil content. These hybrids have good value of important characteristics.

All new hybrids will be given for testing in the network trials of State Institute for Variety testing and Registration, in order to be registered in the Official List.

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