



Mexican safflower varieties with high tolerance to *Ramularia carthami*.

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Abstract

CIANO-LIN, RC-1002, RC-1005 and RC-1033 are four new linoleic varieties and CIANO-OL a new oleic variety with high tolerance to *Ramularia carthami* developed and released by the Yaqui Valley Research Station (CEVY) of the Northwestern Centre for Agriculture Research in Sonora, Mexico. These materials were evaluated under diverse conditions in the safflower production areas in México. Under high humid conditions and different irrigation systems they showed almost 90% more tolerance to *Ramularia carthami* than the conventional commercial varieties Bäum'92, S-518, CW-88OL and CW-99OL. *Ramularia carthami* has impacted on safflower production in México and can cause yield reductions of almost 60%. There are no commercial varieties available in Mexico with resistance or tolerance to this disease. These new varieties will help stabilize the production of both linoleic and oleic safflower in Mexico.

Introduction

Safflower is major oilseed crop grown in Northwestern Mexico. It is grown during the fall – winter season from December to February. The major crop is wheat which is planted from November to December. Wheat consumes more irrigation water than safflower. In this region water is the main limiting factor for agriculture production. As a result, safflower which has low water requirements remains as a major crop alternative in this region.

During the 2000 - 2001 growing season *Ramularia carthami* was first detected in the Yaqui Valley of Sonora, México, causing damages in production of about 60%, but in some cases damages of up to 90% were reported. Since then this disease has been present in all the safflower production areas of México and has been reported in the states of Tamaulipas, Sinaloa, Baja California North, Baja California South as well as the state of Jalisco.

At the moment there are no commercial varieties available in Mexico, resistant or tolerant to this disease. Hence, it was necessary to begin a breeding program in order to develop new varieties with better tolerance to *Ramularia carthami*. On a commercial scale this disease is controlled by use of fungicides in the form of preventive and curative manner implying a very high cost to the grower.

Materials and methods

This research was conducted at the Yaqui Valley Experimental Station-CIRNO-INIFAP located in Ciudad Obregón, Sonora, México. In 2001 a total of 12 combinations between one safflower resistant line was made with different elite lines of the safflower breeding program. The segregating lines were selected by individual plant selections from the F2 until the F4 generation. In the F5, 10 bulk selections were made. In the F6 these were tested in the first yield trial. In the F7 generation these were tested in different locations in México. These materials were also tested under different irrigation systems with the purpose of inducing disease pressure. During the growing season the following agronomic data were registered:



days to flowering, days to physiological maturity, plant height, flower color, reaction to foliar diseases, grain yield, oil content and quality.

Results

Under furrow irrigation system conducted in the Yaqui Valley of Sonora, CIANO-LIN, RC-1002, RC-1005 and RC-1033 showed 90% more tolerance to *Ramularia carthami* than BÁCUM'92 a linoleic commercial variety, on the other hand CIANO-OL showed 70% more tolerance to *Ramularia carthami* than commercial varieties S-518, CW-99OL and CW-88OL. Under rainfall (dryland) conditions these varieties registered 80% more tolerance to *Ramularia carthami* than the commercial varieties. In both conditions compared to the commercial variety BÁCUM'92, RC-1002 flowered 4 days earlier, CIANO LIN and RC-1033 flowered at a similar time, while RC-1005 was 4 days later in flowering. CIANO-OL was similar in flowering period to the commercial checks S-518, CW-99 and CW-88 (Table1).

Table 1. Agronomic data of the new safflower varieties grown in the Yaqui Valley of Sonora, Mexico, 2008

VARIETY	DAYS TO 50% FLOWERING	PLANT HEIGHT (cm)	DISEASE REACTION (1 – 10)	
			Ramularia carthami	Safflower Rust
RC-1033	121	159	0	3
CIANO-LIN	121	153	0	2
RC-1002	117	153	0	1
RC-1005	125	161	0	2
BÁCUM'92 (CHECK)	121	153	9	5
CIANO-OL	125	156	3	1
S-518 (CHECK)	125	148	9	6
CW-99 (CHECK)	125	161	7	5
CW-88 (CHECK)	127	148	7	5



The quality data of the 5 new varieties of safflower are shown in Table 2. Both oil and greased acid percent are acceptable for the oil industry in México.

Table 2: quality data of the new safflower varieties grown in the Yacqui valley of Sonora, Mexico, 2008

VARIETY	Ramularia carthami REACTION	%		
		OIL	OLEIC ACID	LINOLEIC ACID
S-518 (CHECK)	SUSCEPTIBLE	40.8	77.0	12.0
CIANO-LIN	HIGH TOLERANT	41.5		79.6
RC-1002	HIGH TOLERANT	40.5		78.6
RC-1005	HIGH TOLERANT	41.9		77.0
RC-1033	HIGH TOLERANT	40.8		77.7
CIANO-OL	MEDIUM TOLERANCE	37.4	75.0	

Discussion and Conclusion

CIANO-LIN, RC-1002, RC-1005 and RC-1033 are the first linoleic commercial varieties and CIANO-OL the first oleic variety developed and released in Mexico tolerant to *Ramularia carthami*. These varieties will help in stabilizing safflower production in Mexico. In the 2007-2008 season seed production plots were established in different locations in México. These varieties will be made available to Mexican growers as of November of 2008.

References

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