Potential des Anbaus von Saflor (*Carthamus tinctorius* L.) unter den Bedingungen des Ökologischen Landbaus in Mitteleuropa

Potentiality of safflower (*Carthamus tinctorius* L.) Cultivation under Organic Farming Conditions in Central Europe

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Key words: safflower, organic farming, genotype x environment interaction

Schlüsselwörter: Saflor, Ökologischer Landbau, Genotyp-Umwelt-Interaktion

Abstract:
Under organic farming conditions, twenty safflower genotypes were tested for genotype-by-environment interaction (GxE) and stability across four locations in Germany and Switzerland for seed yield and oil content.. ANOVA showed highly significant differences among the genotypes, locations and GxL interactions for yield and oil content. None of the genotypes had a significant regression coefficient or a mean square deviation from the regression coefficient, thereby all genotypes are considered stable for seed yield, whereas, BS-62929 and PI-5724755 were relatively the most stable for oil content.

Introduction:
At world scale, safflower is valued mainly by the quality of its seed-oil that contains highly polyunsaturated fatty acids (VELASCO et al., 2002), as a multi-purpose medicinal plant and a source of the dye carthamin (CORLETO et al. 1997). The objective of the current study is: to evaluate the genotype x environment interactions of adapted safflower material in organic farming systems.

Material and Methods:
Twenty safflower cultivars were used for evaluation of genotype x environment interaction. The cultivars were sown at 4 different locations (Germany, Switzerland) using a simple lattice design (5x4) with four replicates using fifty seeds/m². Seed yield in dt /ha and oil content in percent (cold pressing) were subjected to statistical analyses using PLABSTAT (UTZ, 1997) for evaluation of GxE interactions and stabilities of genotypes.

Results and discussion:
Results from analysis of variance showed highly significant differences among the genotypes, locations and GxL interactions for yield and oil content, that clearly indicates the presence of genetic variability among genotypes as well as the environments and the performance of genotypes which differed over the locations (Table 1). In this study, none of genotypes had a regression coefficient (βi) significantly different from one as well as all genotypes revealed non-significant square mean deviation from regression (δi^2) and all values of correlation coefficient (R^2) were more than 0.88 (Table 2) for yield trait. Thus, all genotypes meet the criteria of stability. For oil content, the considerable variation between βi and the non-significance of δi^2 (Table 2) clarifies the response of genotypes to change in growing conditions and the performance of genotype could be predictable. Regarding both

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traits together, the genotypes PI-572475 and BS-62929 had a significantly higher yield or oil content and revealed a relatively high stability.

Table 1: Analysis of variance of yield (ha/ha) and oil content in % for twenty genotypes tested over our locations in Central Europe during season 2004

	Yield			Oil content (%)		
	DF	C.V.	F. Value	DF	C.V.	F. Value
Location	3	24.89	203.98**	3	28.87	340.04**
Genotype Interaction	19	11.79	10.12**	19	8.09	6.31**
Error	57	5.66	2.10	57	6.20	4.63
Heritabilit	162	5.40		161	3.29	

** significant at 0.01, C.V. is the coefficient of variance. Coefficient of correlation between both investigated traits was –0.736**.

Conclusion:

It can be concluded that, the results emphasised the significant GxE interactions and the necessity for multiple environments testing through time and space to characterise genotypic differences and stabilities. BS-62929 and PI-5724755 may be recommended for cultivation in different locations across Central Europe as they had high relative yield performance and oil content and revealed high stability.

Table 2. Estimates of stability parameters of the traits yield (ha/ha) and oil content in % for twenty genotypes tested over four locations in Central Europe during season 2004

	Yield				Oil content %			
Genotype	χ_i dt/ha	R_i^2	β_i	δ_i^2	χ_i dt/ha	R_i^2	β_i	δ_i^2
Sabina	22.2	0.979	1.345	3.770	12.6	0.999	1.024	0.040
PI-572475	24.4	0.990	0.944	0.850	15.2	0.986	1.036	0.710
PI-209286	22.4	0.983	1.093	2.000	12.4	0.987	0.764	0.350
PI-253518	24.4	0.886	0.802	8.460	12.7	0.973	0.813	0.850
PI-253555	23.7	0.985	1.001	1.490	13.0	1.000	0.748	0.010
BS-62915	24.1	0.988	1.070	1.320	12.8	0.994	0.945	0.270
BS-62924	24.8	0.971	0.903	2.390	13.1	1.000	0.739	0.010
CART-19/89	22.1	0.961	0.973	3.790	13.5	0.985	0.868	0.540
DO-13/03	14.8	0.965	1.017	3.640	16.2	0.999	1.343	0.090
DO-15/03	15.4	0.924	1.053	9.170	16.8	0.996	1.630	0.440
PI_253520	23.9	0.999	1.100	0.120	13.0	0.990	1.079	0.540
PI_537666	22.9	0.990	1.112	1.190	14.2	0.984	1.173	1.030
BS-62913	22.7	0.978	0.710	1.120	12.7	0.995	0.813	0.150
BS-62917	23.6	0.987	1.122	1.610	13.3	0.993	0.899	0.270
BS-62919	23.3	0.960	0.912	3.380	13.3	1.000	1.000	0.010
BS-62922	23.2	0.978	0.992	2.120	13.1	0.990	0.933	0.420
BS-62926	25.4	0.953	0.946	4.400	13.0	0.999	1.024	0.060
BS-62929	25.9	0.957	1.093	5.330	14.0	0.997	1.049	0.170
CART-9/82	21.7	0.931	1.016	7.650	13.4	0.998	1.059	0.100
CART-79/89	23.5	0.890	0.796	7.980	13.0	1.000	1.059	0.020
LSD at 5%	2.51		0.490		1.35		0.230	

BARTLETT's test for mean square deviations from regression coefficients (δi^2) is non significant for both traits. χi, Ri^2,βi are genotypic mean, correlation coefficient and regression coefficients

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