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Performance of canola genotypes in Mato Grosso do Sul, 2006

Gilberto Omar Tomm[1], Jovani Trennepohl[2], Adriano Boni[3], João Carlos Pessato[3], Howard Morris[4], Róger Augusto Tatsch[5]

Picture: Gilberto O. Tomm

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Abstract

Canola genotypes were evaluated in a field experiment, replicated and casualized demonstration plots, and commercial fields, at the municipalities of Maracaju e Sidrolândia, in the state of Mato Grosso do Sul, during the 2006 cropping season. Due to seeding after the recommended period, rainfall during all crop cycle was only 95 mm at the experimental area, and ranged from 70 to 126 mm in the commercial fields. These conditions favoured grain yield of the shorter cycle genotypes, which yielded up to 1.679 kg/ha. Hyola 61, genotype with intermediate cycle, yielded up to 1.100 kg/ha on commercial fields**.** Available technology and its transfer process with engagement of technical personnel and farmers with professional approach and e dedication allowed adequate crop establishment and management indicating great potential for canola crop development in the MS deploying the available commercial genotypes.

[1] Agronomist, Ph.D., Researcher. Embrapa Trigo. Passo Fundo, RS. E-mail: tomm@cnpt.embrapa.br
[2] Agriculture Technician, E-mail: jovanit@top.com.br
[3] Agronomist, COASA E-mail: adrianoboni830@hotmail.com
[4] Regional Director, Pacific Seeds. Towoomba, Qld, Austrália. E-mail: howard.morris@pacseeds.com.au
[5] Trainee at Embrapa Trigo, Student of CEFET, São Vicente do Sul, RS. E-mail: roger.tatsch@gmail.com

Resumo

Híbridos de canola foram avaliados em experimento de genótipos, em parcelões demonstrativos com repetições casualizadas e em lavouras comerciais, nos municípios de Maracaju e de Sidrolândia, no Mato Grosso do Sul, na safra de 2006. A precipitação pluvial foi de 95 mm durante todo o ciclo de cultivo de canola na área experimental e variou de 70 a 126 mm nas lavouras comerciais. Estas condições favoreceram o rendimento de grãos dos genótipos mais precoces, com rendimentos de até 1.679 kg/ha. O rendimento de Hyola 61, genótipo de ciclo médio, chegou a 1.100 kg/ha nas lavouras comerciais. As tecnologias disponíveis e o processo de transferência com envolvimento de técnicos e produtores permitiram adequado estabelecimento e condução de lavouras, indicando grande potencial para desenvolvimento do cultivo de canola no MS empregando-se os genótipos comerciais disponíveis.

Introduction

Commercial production of canola in the state of Mato Grosso do Sul (MS) began in 1994 promoted by Cooperativa Agroindustrial - COCAMAR[6], in the region of Aral Moreira, was mantained up to the year 2000, and reached a peak of 1500 ha in the year 1998. In the following years canola production continued in up to 1000 ha annually at municipalities near the border with Paraguay. Bunge Alimentos S.A. started in 2006 a program to develop commercial production of canola in MS, in the municipalities of Maracaju and Sidrolândia with the technical support of the first author and technical assistance to farmers by the second author.

It has been observed in the state of MS as in other states of the “Centro-Oeste” region of Brazil growing interest of farmers and companies to increase grain production as a second crop in the year, called “safrinha”, following soybean or maize production. However, in certain years low rainfall during “safrinha”, and frost in some areas, are important limiting factors, especially if seeding is not done in the recommended period, from mid February to mid March.

Aiming at generating information to support the choice of canola genotypes more adapted and with more grain yield potential under the environmental conditions of this region a genotype trial and replicated demonstration plots were established. Information about commercial fields were also collected and analysed.

Materials and Methods

A genotype competition experiment with four reps displayed in a RCBD a well as randomized demonstration plots, with two reps, were carried under no tillage, having soybean as the previous crop, at “Fazenda Pouzinho” located near the town Maracaju, MS, Latitude 21° 78’ 02”, Longitude 55°23‘ 45”, altitude of 470 m above sea level.

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[6] Verbal communication of the Agronomist José Roberto Gomes, of COCAMAR, to Gilberto Omar Tomm, on 13 October, 2006.

Soil of the experiment area is classified as Red Distroferric Latosol, is derived from basalt, presents 60-70% clay (other parameters presented on Table 1).

Table 1. Characteristics of soil fertility before sowing the canola experiments

V%	pH	P	K	CTC	M.O.	S	Bases[1]	Ca	Mg	Al	H+Al
		mg/dm^3	$Cmol_c/dm^3$		$\%(g/dm^3)$	mg/dm^3	$Cmol_c/dm^3$	-----$cmol_c/dm^3$----			
40	4.5	3-6	0.2-0.3	10-11	2.1-2.5	30-50	3.6-5.0	2.5-4.0	0.8-1.1	1.5-1.8	6.4-7.3

[1] Sum of exchangeable bases

Prior to seeding a commercial no-till drill was deployed to place fertilizers in the furrows used for placing the seeds just after. In this operation 100 kg of Urea (46% N) + 100 kg of Ammonium Sulphate (21% N and 24% S) + 100 kg Potassium Chloride (60% KCL) + 100 kg of formulated NPK (10.5-54-00) adding to a total of 77.5 kg of N, 54 kg of P_2O_5 and 60 kg of K_2O and 24 kg of S were applied.

Hand seeding was done on 12 April 2006 and emergence was observed on 20 April. Plots had 4 rows of plants, with row spacing of 0.40 m and 5 m length, making an area of 8 m^2 (Fig. 1) Demonstration plots, replicated twice, had 5 rows of plants, spaced 0.4 m and were 20 m long totalling 40 m^2 each and were located besides the other genotype experiment.

Picture: Jovani Trennepohl

Fig. 1. General aspect of the trial on 14 June 2006.

After seeding Clorpirifos (Clorpirifos 480 EC, 800 mL/ha) was sprayed to control caterpillars. On 12 June, the insecticide Clorpirifos (Clorpirifós 480 EC, 100 mL/ha) + Metomil (Lannate 215 SL, 500 mL/ha) were applied also for the control of caterpillars.

Grain yield was estimated based on the harvest of the two central rows of plants with 4 m length (3.2 m^2). On the demonstration plots the mean of two sub-samples of 3.2 m^2 were used to estimate grain yield. Harvest was done by hand and plants were left in bags for drying up to about 10% moisture and then threshed with a plot threshing machine. Grain samples were cleaned using a set of sieves.

Phenological observations were made based on criteria adopted in Canada and Australia[1], as follows. Emergence date: day at which 50% of the seedlings of the plot emerged. Beginning of flowering: day at which 50% of the plants present at least one flower. End of flowering: day when there are no more flowers, except on off type plants. Plant height: average plant height up to the upper extreme of the branches with pods. Maturation date: day at which 50% of the seeds have their colour turning to dark on the pods situated on the central part of the raceme of the plants. A subjective assessment of the level of drought stress was made based on the visual aspect of plants with grades ranging from 1= very drought stressed aspect to 9=no stress (normal looking plants).

Rainfall from seeding to harvest added to only 95 mm (Table 2) and long periods with no rain were observed during the experiment. To provide an idea about the usual rainfall in that region, at the "Núcleo Experimental of Fundação MS, in Maracaju, MS, the average rainfall from March to July in the years 1995 to 2004 was 309 mm with the following distribution: March, 14 mm; April, 105 mm; May, 82 mm; June, 70 mm; and, in July, 38 mm (Fundação MS, 2005).

Table 2. Precipitation during the experiment, in Maracaju, 2006.

Date	Precipitation (mm)
14 April	20
20 May	10
10 June	16
13 June	15
27 June	14
20 July	20
Total	95

Commercial canola fields were established after a training meeting for technical personnel and farmers. A total de 3224 hectares were sown in the municipality of Maracaju by the fourth author, with technical assistance of the third author. Twelve canola fields were sown in the municipalities of Maracaju and Sidrolândia with the technical assistance of the second author. Characteristics, management and other details of each field are present on Table 3.

[1] Informed by e-mail of dr. Greg Buzza, canola breeder of Advanta Canada Inc., to Gilberto Omar Tomm, on 16 April 2003.

Table 3. Technological aspects and grain yield of the commercial fields of canola in the state of MS, with technical assistance by Jovani Trennepohl, during 2006.

Farmer	Municipality	Area (ha)	Row spacing (m)	Altitude (m)	Rain (mm)	Seeds (kg/ha)	Fertilizer		Date of			Harvest (ha)	Grain yield (kg/ha)
							Formula	kg/ha	Seeding	Emergence	Harvest		
D. K.	Maracaju	200	0.45	519	90	2.5	Uréia	100	28/03 - 14/04	08/04 - 25/04	11/08	180	928
J. P. de R.	Maracaju	150	0.36	472	70	2.5	10.28.08	250	13/03	28/03	08/08	80	621
J. S.	Maracaju	240	0.40 – 0.17	508	70	2.5	12.15.15 +12S	300	28/03 - 04/05	28/04 - 15/05	18/08	60	139
L. B.	Sidrolândia	320	0.17	470	92	2.6	12.15.15+12% S	250	04/04 - 12/04	18/04	06/08	320	1100
M. K.	Maracaju	200	0.45	380	100	2.4	08.20.20	200	23/03 - 02/04	30/03 - 10/04	05/08	197	650
M. C.	Sidrolândia	300	0.16	531	80	2.5	08.18.17 +5%S	202	18/04	25/04 - 20/05	22/08	100	94
M. M.	Maracaju	323	0.50	442	90	2.5	10.28.08	180	01/04 - 04/04	10/04 - 14/04	23/08	323	484
R. B.	Sidrolândia	340	0.17	570	126	2.5	12.15.15+12S	200	05/04 - 10/04	10/04 - 16/04	06/08	340	1074
R. D.	Maracaju	300	0.40	436	70	2.5	08.20.20+6%S	200	01/03 - 25/03	10/03 - 05/04	08/08	80	125
R. M.	Sidrolândia	100	0.17	580	80	2.5	10.28.08	200	27/04	10/05 - 15/05	--	5	0
S.T.	Maracaju	120	0.42	444	70	2.5	08.20.20	200	28/02 - 10/03	06/03 - 20/03	27/06	80	274
W. H. V.	Maracaju	100	0.44	408	126	2.5	08.20.20	200	16 - 28/03	20/03 - 06/04	04/08	100	866
Average				**480**	**90**	**2.5**							**726**
Total		**2693**							**28/02 - 14/04**			**1,865**	

Results and Discussion

Air temperatures that reached about 40ºC along with major shortage of soil moisture at the beginning of June were the likely cause of the death of the top part of plants followed by development of saprophytic organisms generating a dark mass with aspect that resembles bunt (Fig. 2).

Picture: Jovani Trennepohl

Fig. 2. Death of the apical part of plants likely due to the effect of high air temperatures combined with moisture stress in the beginning of June 2006. Maracaju, MS, 2006.

Symptoms of the Blackleg disease, incited by the fungi *Leptosphaeria maculans* (*Phoma lingam*), were not observed on susceptible genotypes (Y3000, Hyola 401 and Hyola 420) of the genotypes experiment and demonstration plots. In the region of the experimental area no blackleg was ever observed and likely because neither inoculum nor favourable environmental conditions for the disease were available.

Genotype trial

Initial plant population ranged from 10 to 21 plants/m^2 (except for Hyola 60 with 3 plants/m^2), averaged 15 plantas/m^2 and did not present correlation with grain yield (data not presented). Seeds of Hyola 60 were more than a year old and had low vigour. Harvest was done from 26 July to 17 August.

Only the subjective assessment of the visual effect drought stress on plants presented a significant correlation explaining 31% of the variation in grain yield (Table 4).

Hyola 401 and H4816 presented the shortest cycle from emergence to harvest of all genotypes, 97 days, and differ statistically from the other genotypes. Although no significant difference in grain yield was observed Hyola 401 and H4816 presented the highest absolute yields of the trial. This has been observed whenever the rainy season is short and there is shortage of moisture at the end of the cycle as in the northern areas of the state of Paraná, such as Maringá (Tomm *et al.*, 2003). Although oil content differed among genotypes no statistical significant differences among genotypes were detected on oil yield per area.

Table 4. Performance of canola genotypes in Maracaju, MS, 2006.

Genotype	Emergence to beginning of flowering (days)	Duration of flowering (days)	Emergence to maturation (days)	Plant height (cm)	Drought stress[1] (%)	Thousand kernel weight (g)	Grain yield (kg/ha)	Oil content (%)	Oil yield (kg oil/ha)
H4481	47a	50c	116b	108bc	5ab	4.0bcd	914	35.6abc	328
H4592	47a	50c	119a	105bc	4b	4.0bcd	879	37.7a	332
H4722	46b	47d	109c	112ab	7ab	4.0bcd	1,000	37.2ab	372
H4815	45c	46e	103d	105bc	5ab	4.5a	680	35.6abc	243
H4816	45c	45f	97e	103bc	8a	3.8cd	1,099	36.8abc	404
Y3000	44d	46e	109c	101bc	6ab	4.5a	703	35.6abc	253
Hyola 43	44d	52b	116b	109bc	7ab	3.8d	974	36.7abc	358
Hyola 60	45c	54a	119a	131a	8a	3.9bcd	794	35.6abc	283
Hyola 61	43e	47d	109c	109bc	8a	3.7d	969	35.4bc	342
Hyola 401	39f	50c	97e	91c	8a	4.3ab	1,113	34.6c	386
Hyola 432	47a	50c	119a	120ab	4b	4.2abc	695	36.4abc	253
Média	45	49	110	108	6.3	4.0	892	36.1	323
CV (%)	1	0.5	1	8	21.2	4.1	29	2.5	30
Pr>F	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.18	<0.01	0.22
Correlation with canola grain yield									
r^2	(-)0.07	(-)<0.01	(-)0.07	(-)<0.01	0.31	(-)0.09	--	0.08	0.99
Pr>F	0.10	0.75	0.08	0.92	<0.01	0.05	--	0.08	<0.01

Means in each column, followed by the same letter, do not differ among themselves, by the Tukey test, at the level of 5% of error probability.
[1]1= Strong symptoms of drought stress, to 9= no stress.

Demonstration plots

In the demonstration plots plant population at harvest ranged from 10 plants/m^2 (Hyola 401), to 17 plants/m^2 (Hyola 43) (Fig. 3).

As in the genotype trial the high coefficient of variation led to no significant grain yield differences between genotypes (Table 4). Hyola 420, not tested in the trial, presented the highest absolute grain yield, 1679 kg/ha.

Thousand grain weight was the only estimated characteristic presenting significant correlation with grain yield and explained 56% of its variation, which was not the case in the genotype experiment.

Picture: Jovani Trennepohl

Fig. 3. General aspect of the demonstration plots during flowering. Maracaju, MS, 2006.

Table 5. Performance of canola genotypes in demonstration plots with two replicates, Maracajú, MS, 2006.

Genotype	Emergence to beginning of flowering (days)	Duration of flowering (days)	Emergence to maturation (days)	Plant height (cm)	Drought stress[1] (%)	Thousand kernel weight (g)	Grain yield (kg/ha)	Oil content (%)	Oil yield (kg oil/ha)
Hyola 401	40d	41b	97c	92c	8	4.2	1,589	34.7	552
Hyola 420	61b	33c	116b	119b	7	4.2	1,679	37.6	632
Hyola 43	44c	52a	116b	97c	8	3.8	1,217	34.6	434
Hyola 60	66a	33c	125a	129a	8	3.7	1,213	37.4	453
Média	53	40	114	109	8	3.9	1,424	36.1	518
CV (%)	1	1	1	1	4	3.0	17	10.8	25
Pr>F	<0.01	<0.01	<0.01	<0.01	0.08	0.04	0.29	0.8	0.5
Correlation with canola grain yield									
r^2	(-)0.08	(-)0.10	(-)0.20	(-)0.02	0.14	0.56	--	0.28	0.93
Pr>F	0.85	0.46	0.27	0.77	0.37	0.03	--	0.18	>0.01

Means in each column, followed by the same letter, do not differ among themselves, by the Tukey test, at the level of 5% of error probability.
[1]1= Strong symptoms of drought stress, to 9= no stress.

Commercial fields

As part of canola production support program launched by Bunge Alimentos S. A. in the state of Mato Grosso do Sul 5917 hectares were sown in 2006. One farmer seeded 1326 ha of Hyola 43 plus 1898 ha of Hyola 61, adding to 3224 ha. Another twelve farmers seeded areas of 100 to 340 ha each, all of Hyola 61, making a total of

2693 ha in which they averaged 726 kg of grain/ha (Table 3). Rainfall during the growing season averaged a total of 90 mm, and ranged from 70 to 126 mm, which likely limited crop performance.

The best average yields were obtained with the use of the 17 cm row spacing. This is in close agreement with results on experiments employing old open pollinated cultivars in colder environments of the state of Rio Grande do Sul as well as in more similar environments as those of the experiments and commercial fields in the state of Goiás (Tomm, et al, 2005). Samplings in places of the canola fields that visually suggested higher yield potential in the farm located at latitude 21° 47' 03", longitude 55°25'23", altitude of 442 m above the average sea level, in the municipality of Maracajú (Table 5), reached 2664 kg/ha.

Seeding of the trial and demonstration plot was done on 12 April, about one month after the recommendation. On farmers fields seeding went up to 4 May. Tomm et al. (2003) observed in Maringá, PR, also an environment with limited and decreasing moisture availability as seeding is delayed, that short cycle genotypes, such as Hyola 401, present higher grain yield. Likely due to this reason shorter cycle genotypes are more suitable whenever seeding time is delayed and environmental conditions are like these observed in 2006, year in which rainfall was low and stopped on 20 July, many days before the end of the maturation of longer cycle genotypes on 17 August.

Observations on the performance of Hyola 61 in areas with more soil moisture, because they were in lower spots, present with higher soil organic matter content, suggest that this hybrid is very suitable for the growing conditions of this region of the state of Mato Grosso do Sul. Grain yield of 1074 and 1100 kg/ha in two fields of 340 and 320 ha, with only 126 and 92 mm rainfall, respectively, indicate that Hyola 61 is very suitable and will express adequate grain yield potential if more normal rainfall conditions are available, which is likely to happen by following the seeding time that has been recommended.

Conclusions

Available technology and its transfer process allowed adequate crop establishment and management of commercial fields indicating great potential for development of canola cropping in MS with the available genotypes and engagement of technical personnel and farmers with com professional behaviour and dedication.

Results of the experiment, demonstration plots and commercial fields provided evidence of the high tolerance of canola genotypes to the conditions of only 100 mm rainfall during all crop cycle that can occur during the second crop of the year, "safrinha". However, seeding of canola after the recommended period determined high water stress which likely was the most limiting factor to grain yield specially for the genotypes with longer cycle.

Results obtained in the experiments and commercial fields showed the suitability of the species and of the deployed canola genotypes and their yield potential under the soil and climatic conditions of the region. Seeding earlier would have allowed crop development in a period of time with less moisture stress. This aspect and the improvement of other technological aspects related to canola crop management in commercial fields, specially the adoption of 0.17 row spacing, as observed in the farms with the highest grain yields, can contribute for a better expression of the genetic potential of this plant species and a better economic return to farmers.

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Embrapa Trigo
Caixa Postal, 451, CEP 99001-970
Passo Fundo, RS
Fone: (54) 3316 5800
Fax: (54) 3316 5802
E-mail: sac@cnpt.embrapa.br

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