ABSTRACT: 339

DETECTING SOYBEAN COMMERCIAL CULTIVARS WITH SPECIFIC ADAPTATION ON A BROAD AREA OF ARGENTINA

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Typically, the yield data generated from crop breeding and evaluation programmes arises from a series of field trials known as multi-environment trials. These trials allow the investigation of varietal yield performance across a range of geographic locations and years. Previously, it was shown, for a restricted area of Argentina, there is a different performance in some soybean commercial cultivars. In this work, we analyzed 9343 records, each one obtained from a 2 or 3 plot average of absolute (kg/ha) or relative to the trial average yields (%). These trials are included in the RECSO (INTA ASA multi environment yield trials) and were sown in a broader area within 17 locations, from Las Breñas (Chaco, lat -27,05) to Gualeguay (Entre Ríos, lat -33,10) from 2002-2010. The yield stability index was obtained from the Finlay & Wilkinson (1963) methodology (slope of a linear regression between each cultivar yield and the average yield of each environment where the cultivar was present). The "b" slope constitutes that index. We tested the hypothesis of $b \neq 1$. Varieties present in more than 10 environments were sorted by "b". Even though the majority of the varieties' "b" was not different from 1 (b=1, i.e. strong yield stability), we detected 40 with a slope significantly different ($p<0.05$) from "1" and 26 with slight differences ($0.05<p<0.10$) from "1". We show varieties with $b<1$, i.e. adapted to low yielding environments and those with $b>1$, i.e. recommended for high yielding environments.

DETECTING SOYBEAN COMMERCIAL CULTIVARS WITH AN SPECIFIC ADAPTATION ON A BROAD AREA OF ARGENTINA

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Cultivars choice depends on..

- 1. Commercial availability
- 2. Yielding potential (RECSO score)

- 3 Yield stability

- *Typically, the yield data generated from crop breeding and evaluation programmes arises from series of field trials known as multi-environment trials (Smith et al 2005).*
- *These trials allow the investigation of varietal yield performance across a range of geographic locations and years (Smith et al 2005).*
- *Previously, it was shown, for a restricted area of Argentina, a different performance in some soybean commercial cultivars (Santos et al 2009).*

- To assess new cultivars performance, multi-environment trials (MET), like the Argentinean **RECSO** are useful, and have a double scope:
  - i) obtain a yield **ranking** between varieties (comparative trial), and
  - ii) check each variety yield stability between environments (network of trials).

- In this work, we analyzed 9343 records each one obtained from a 2 or 3 plots average of absolute (kg/ha) or <u>relative to the trial average</u> yields (%).
- These trials are included in the RECSO (INTA ASA multi environment yield trials) and were sown in broader area within 17 locations, from Las Breñas (Chaco, lat -27,05) to Gualeguay (Entre Ríos,lat -33,10) between 2002 and 2010.

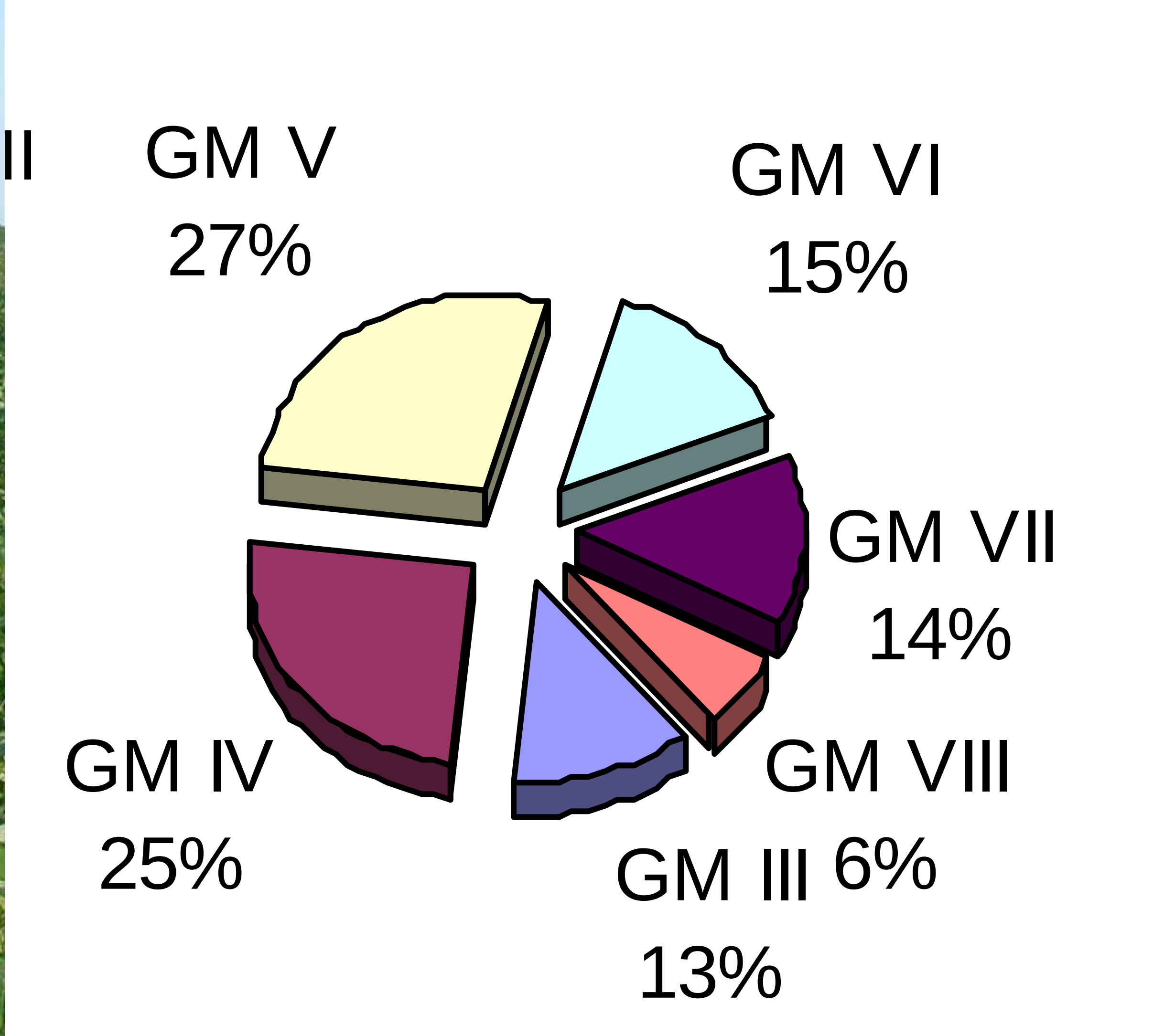
- Yield stability index was obtained from the Finlay y Wilkinson (1963) methodology (slope of a linear regression between each cultivar yield and the average yield of each environment where the cultivar was present).
- The “b” slope constitutes that index. We tested the hypothesis of $b \neq 1$. Varieties present in more than 10 environments were sorted by “b” .

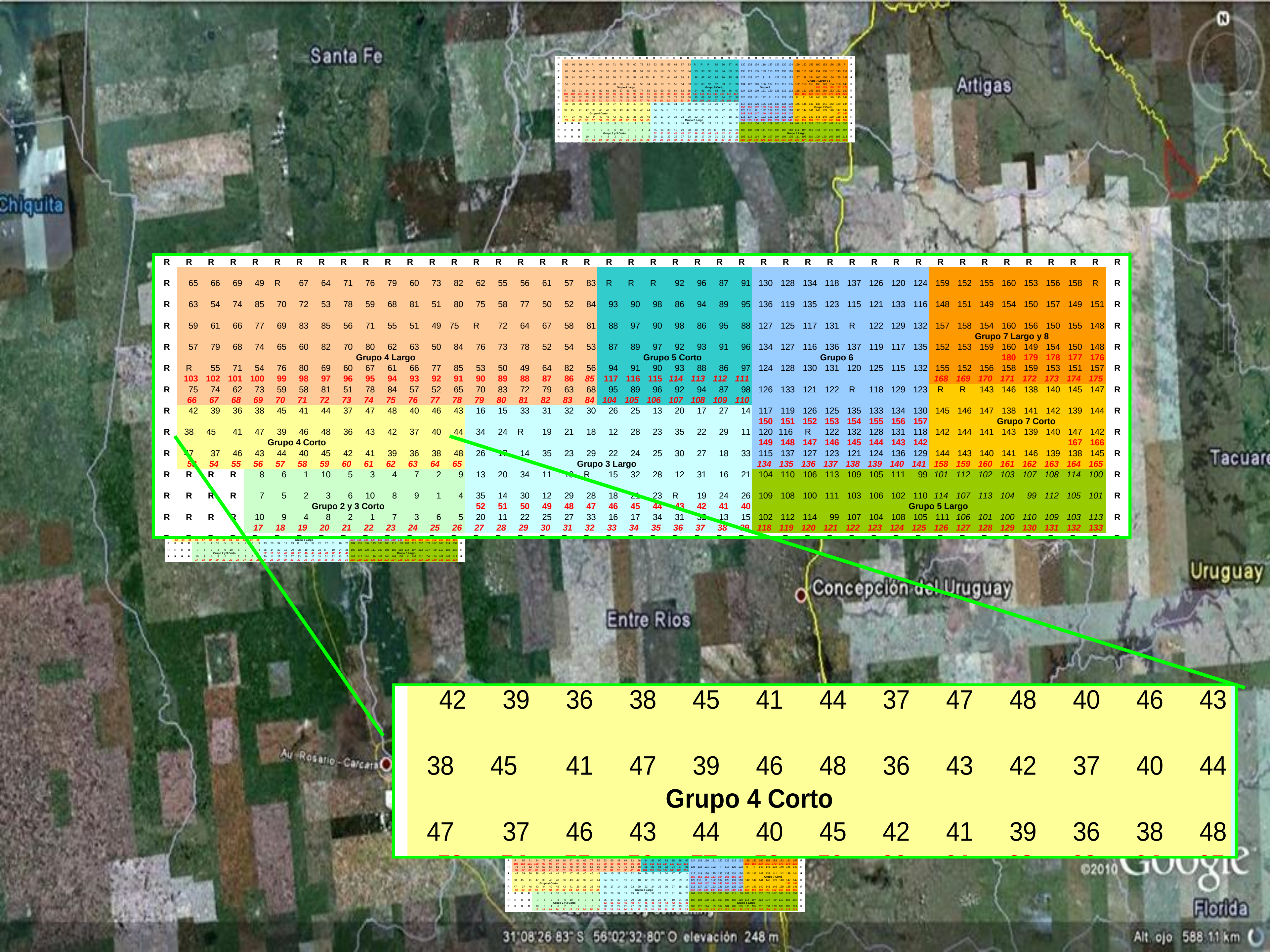
Methods and materials

- 9343 three-plots-averages sown in a broad area
- within 17 locations,from Las Breñas (Chaco, lat -27,05) to Gualeguay (Entre Ríos,lat -33,10)
- between 2002 and 2010.

Materiales y métodos

413 **cultivars**
from MG III to VIII





R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
R	65	66	69	49	R	67	64	71	76	79	60	73	82	62	55	56	61	57	83	R	R	R	92	96	87	91	130	128	134	118	137	126	120	124	159	152	155	160	153	156	158	R	R
R	63	54	74	85	70	72	53	78	59	68	81	51	80	75	58	77	50	52	84	93	90	98	86	94	89	95	136	119	135	123	115	121	133	116	148	151	149	154	150	157	149	151	R
R	59	61	66	77	69	83	85	56	71	55	51	49	75	R	72	64	67	58	81	88	97	90	98	86	95	88	127	125	117	131	R	122	129	132	157	158	154	160	156	150	155	148	R
																																						Grupo 7 Largo y 8					
R	57	79	68	74	65	60	82	70	80	62	63	50	84	76	73	78	52	54	53	87	89	97	92	93	91	96	134	127	116	136	137	119	117	135	152	153	159	160	149	154	150	148	R
										Grupo 4 Largo													**Grupo 5 Corto**								**Grupo 6**							180	179	178	177	176	
R	R	55	71	54	76	80	69	60	67	61	66	77	85	53	50	49	64	82	56	94	91	90	93	88	86	97	124	128	130	131	120	125	115	132	155	152	156	158	159	153	151	157	R
	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	117	116	115	114	113	112	111									168	169	170	171	172	173	174	175	
R	75	74	62	73	59	58	81	51	78	84	57	52	65	70	83	72	79	63	68	95	89	96	92	94	87	98	126	133	121	122	R	118	129	123	R	R	143	146	138	140	145	147	R
	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	104	105	106	107	108	109	110																	
R	42	39	36	38	45	41	44	37	47	48	40	46	43	16	15	33	31	32	30	26	25	13	20	17	27	14	117	119	126	125	135	133	134	130	145	146	147	138	141	142	139	144	R
																											150	151	152	153	154	155	156	157					**Grupo 7 Corto**				
R	38	45	41	47	39	46	48	36	43	42	37	40	44	34	24	R	19	21	18	12	28	23	35	22	29	11	120	116	R	122	132	128	131	118	142	144	141	143	139	140	147	142	R
						Grupo 4 Corto																					149	148	147	146	145	144	143	142							167	166	
R	47	37	46	43	44	40	45	42	41	39	36	38	48	26	17	14	35	23	29	22	24	25	30	27	18	33	115	137	127	123	121	124	136	129	144	143	140	141	146	139	138	145	R
	53	54	55	56	57	58	59	60	61	62	63	64	65							**Grupo 3 Largo**							134	135	136	137	138	139	140	141	158	159	160	161	162	163	164	165	
R	R	R	R	8	6	1	10	5	3	4	7	2	9	13	20	34	11	19	R	15	32	28	12	31	16	21	104	110	106	113	109	105	111	99	101	112	102	103	107	108	114	100	R
R	R	R	R	7	5	2	3	6	10	8	9	1	4	35	14	30	12	29	28	18	21	23	R	19	24	26	109	108	100	111	103	106	102	110	114	107	113	104	99	112	105	101	R
								Grupo 2 y 3 Corto						52	51	50	49	48	47	46	45	44	43	42	41	40									**Grupo 5 Largo**								
R	R	R	R	10	9	4	8	2	1	7	3	6	5	20	11	22	25	27	33	16	17	34	31	32	13	15	102	112	114	99	107	104	108	105	111	106	101	100	110	109	103	113	R
				17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	

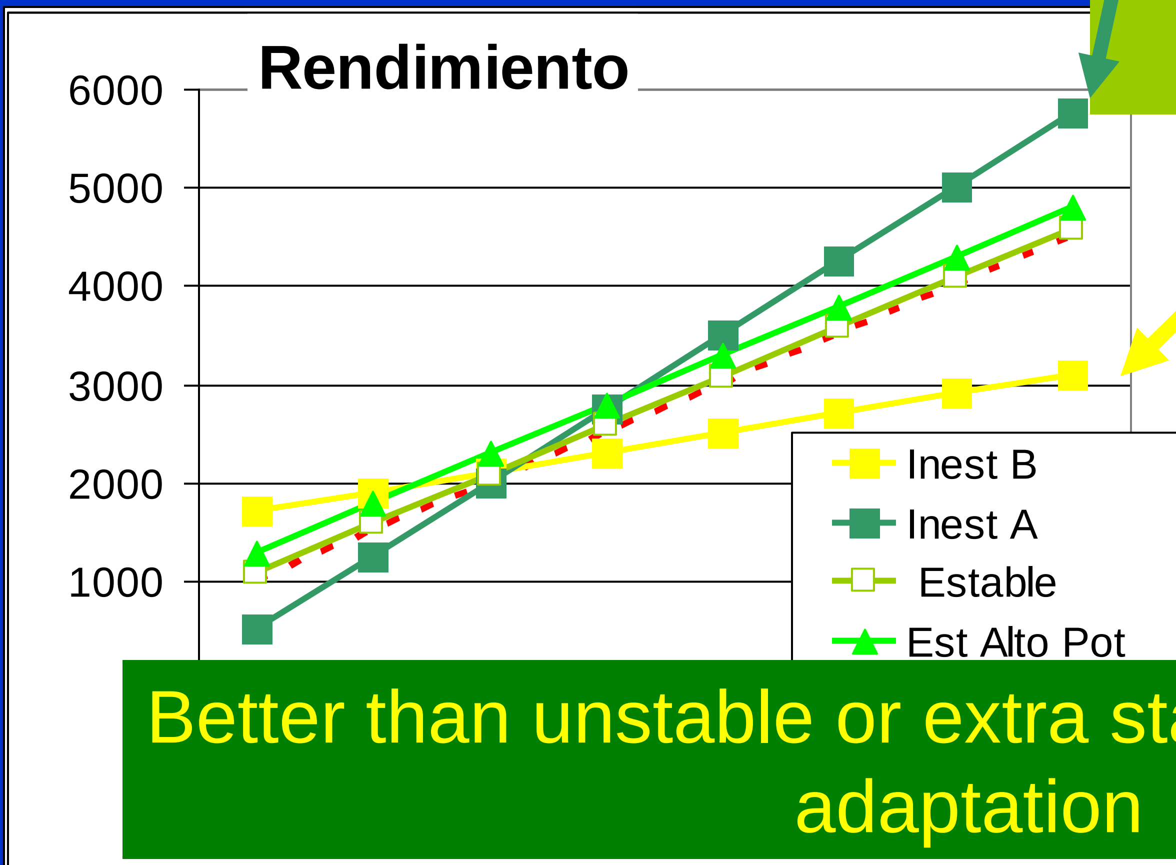
42	39	36	38	45	41	44	37	47	48	40	46	43
38	45	41	47	39	46	48	36	43	42	37	40	44
				Grupo 4 Corto								
47	37	46	43	44	40	45	42	41	39	36	38	48

Yield stability, again methodology

- Within the Finlay y Wilkinson (1963) approach:
  - An individual linear regression FOR EACH CULTIVAR is performed, where ITS OWN YIELD in each environment (Y axis) is related to the all-cultivars-average yield in that environment (X axis).
  - We also check the hypothesis for the slope being equal to one (b=1).

Those cultivars with a slope=1 are stable and with a broad adaptation

When the yield slope is >**1,** cultivars are called unstable with HQ environments' adaptation "race horses" type



When the yield slope is < 1, cultivars are "extra-stables" with LQ environments' adaptation, "work horse" type

Better than unstable or extra stable? With specific adaptation

What are we looking for: a friendly table for agricultural professionals that include not only varieties YIELD POTENTIAL but also YIELD STABILITY…

- Data in the output:
  - Variety/Cultivar
  - N (number of enviroments where it was sown)
  - **b**, slope, INDICATING THE YIELD STABILITY
  - RY, relative yield (an average of all the RY the variety's achieved)
  - Table can be ordered by **increasing "b"** showing three categories: i) those adapted to low-enviroments (dryland with water deficits), ii) those stables, and iii) those adapted to irrigation
  - **We highlight in bold font: RY > 102%**

Traditional INTA E Ríos tab

- MG III as an example

Variedad	N	*b*	RR
ACA 360GR	17	***0,87***	*95,9*
NA 3933RG	10	***0,88***	*97,3*
DALIA 390	**17**	***0,89***	***104,9***
DM 3500	11	***0,91***	*101,0*
DM 3700	**22**	***0,94***	***104,6***
NA 3731RG	13	***0,95***	*102,4*
AZUL35RR	12	***0,96***	*102,4*
SPS 3800	15	***0,99***	*91,8*
FN 360	**11**	***1,05***	***104,7***
A 3302RG	17	***1,07***	*98,0*
SP 3900	**15**	***1,08***	***104,2***
DM 3100	13	***1,13***	*101,2*
ALM3530	13	***1,16***	*102,9*

variety	N	b		test "b ≠ 1"
RA 733	14	*0,7232*	**	0,0207
NKCOKER 80	12	*0,7690*	*	0,0607
SRM 5700	20	*0,8220*	**	0,0031
TJs 2145	19	*0,8311*	**	0,0955
SYCOKER 7X	14	*0,8326*	*	0,0719
SRM 4839	27	*0,8328*	**	0,0170
SP 6X2	33	*0,8352*	**	0,0354
NS 8004	17	*0,8380*	*	0,0801
ACA 720GR	19	*0,8576*	**	0,0308
ACA 570GR	25	*0,8655*	**	0,0107
RAR 505	14	*0,8713*	*	0,0613
A 7636RG	44	*0,8986*	**	0,0439
NA 8010RG	34	*0,9094*	**	0,0482
CHAMPAQUI 580	57	*0,9228*	*	0,0532
MERCEDES 76	25	*0,9246*	*	0,0950
ANDREA 60	51	*0,9293*	**	0,0161
TJs 2068	51	*0,9304*	*	0,0871
ANTA 83RR	22	*0,9364*	*	0,0931
RA 626	55	*1,0800*	**	0,0322
A 6411RG	66	*1,0835*	*	0,0796
TJ 2178	41	*1,0950*	**	0,0462
DM 4600	34	*1,0954*	*	0,0778
MIREYA 42	13	*1,0997*	**	0,0327
DM 62i	26	*1,1144*	*	0,0757
SPS 4900	11	*1,1230*	*	0,0871
RAR 509	23	*1,1257*	**	0,0447
FN 5-45	31	*1,1261*	**	0,0413
NA 8164RG	26	*1,1411*	**	0,0443
RMO 75i	39	*1,1430*	**	0,0042
A 7322RG	16	*1,1456*	**	0,0275
NS 7211	23	*1,1610*	**	0,0355
SRM 6001	17	*1,1622*	*	0,0741
SRM 4370	13	*1,1645*	**	0,0147
ALM 4200R	16	*1,1645*	**	0,0277
A 7053RG	32	*1,1705*	*	0,0511
DM 59i	38	*1,1716*	**	0,0324
BIO 380	10	*1,2375*	**	0,0420
RA 338	10	*1,2543*	*	0,0921
ACA 4550	18	*1,2734*	**	0,0498

- In this work, even though the majority of the varieties' "b" was not different from 1 (b=1, ie strong yield stability), we detected 40 with a slope significantly different ($p<0.05$**) from"1" and 26 with slightly differences ($0.05<p<0.10$*) from "1".

variety	N	*b*		test "b ≠ 1"
RA 733	14	*0,7232*	**	0,0207
NKCOKER 80	12	*0,7690*	*	0,0607
SRM 5700	20	*0,8220*	**	0,0031
TJs 2145	19	*0,8311*	**	0,0955
SYCOKER 7X	14	*0,8326*	*	0,0719
SRM 4839	27	*0,8328*	**	0,0170
SP 6X2	33	*0,8352*	**	0,0354
NS 8004	17	*0,8380*	*	0,0801
ACA 720GR	19	*0,8576*	**	0,0308
ACA 570GR	25	*0,8655*	**	0,0107
RAR 505	14	*0,8713*	*	0,0613
A 7636RG	44	*0,8986*	**	0,0439
NA 8010RG	34	*0,9094*	**	0,0482
CHAMPAQUI 580	57	*0,9228*	*	0,0532
MERCEDES 76	25	*0,9246*	*	0,0950
ANDREA 60	51	*0,9293*	**	0,0161
TJs 2068	51	*0,9304*	*	0,0871
ANTA 83RR	22	*0,9364*	*	0,0931
RA 626	55	*1,0800*	**	0,0322
A 6411RG	66	*1,0835*	*	0,0796
TJ 2178	41	*1,0950*	**	0,0462
DM 4600	34	*1,0954*	*	0,0778
MIREYA 42	13	*1,0997*	**	0,0327
DM 62i	26	*1,1144*	*	0,0757
SPS 4900	11	*1,1230*	*	0,0871
RAR 509	23	*1,1257*	**	0,0447
FN 5-45	31	*1,1261*	**	0,0413
NA 8164RG	26	*1,1411*	**	0,0443
RMO 75i	39	*1,1430*	**	0,0042
A 7322RG	16	*1,1456*	**	0,0275
NS 7211	23	*1,1610*	**	0,0355
SRM 6001	17	*1,1622*	*	0,0741
SRM 4370	13	*1,1645*	**	0,0147
ALM 4200R	16	*1,1645*	**	0,0277
A 7053RG	32	*1,1705*	*	0,0511
DM 59i	38	*1,1716*	**	0,0324
BIO 380	10	*1,2375*	**	0,0420
RA 338	10	*1,2543*	*	0,0921
ACA 4550	18	*1,2734*	**	0,0498

- We show both with b <1, ie adapted to low yielding environment and those with b>1, ie recommended for high yielding environments (Tollenaar y Lee, 1992).

Then (Conclussions)

- Plus than commercial availability and yield potential, yield stability should be taken into account for the cultivars' choice.
- Which are the selected cultivars, is not the main notice here
- Even though it is simple and very explicit, the Finlay-Wilkinson method for assessing yield stability is not new
- Our proposal is to give **a new way** to show the results making them useful for the on farm assessments

- This presentation could have been named "re-styling the Finlay y Williams model output"!!!!

Thank you!!!

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