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STUDIES ON STABILITY FOR GREEN AND DRY FORAGE YIELD IN RYEGRASS (*Lolium multiflorum, L*)

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ABSTRACT

This investigation was conducted at Sakha, Gimmeza and Sids experimental stations in two successive seasons 1999/2000 and 2000/2001, to estimate stability parameters in five introduced genotypes of ryegrass (*Lolium multiflorum* L.) for green and dry forage yield. Mean squares of genotypes, environments and genotype by environment interactions were highly significant for green and dry forage yield. The all mixtures of Berseem with ryegrass gave the highest green and dry forage yield comparing by planting ryegrass in pure stand. Planting ryegrass with 10 Kg./Fed. in mixture gave the highest green yield at Sids St. in the 1999/2000 season. Caramba gave the highest green and dry forage yield. For both characters, nonsiginificant values of b_i revealed average response for all genotypes except Caramba for green forage yield. All genotypes showed significant non-linearity S^2d_i. for green forage yield as well as the genotype Mt 1465 Primora for dry forage yield.. The four genotypes i.e. Caramba, Mt 337 Tewera, Mt380 Terwatco and Clipper were most promising and of practical utility for forage production under both poor and good management conditions and these could be used as a stable and high yielding genotypes in breeding programs

INTRODUCTION

Italian ryegrass (*Lolium multiflorum* L.) is a native annual winter grass in the Mediterranean region and adapted to a wide range of soil. It could be grown alone or as a forage crop in mixtures with Berseem under local conditions of Egypt. The yielding ability of most of the varieties varied under different environmental conditions. So, stability in yielding ability is one of the most desirable properties of genotype to be released for cultivation. For this purpose the multilocations trials over a number of years are conducted. Sometimes the unilocational trials can also serve the purpose provided different environments are created by planting experimental materials at different dates of sowing, using various spacing and doses of fertilizers, irrigation levels and seeding rates etc. (Luthra *et al.* 1974 and Tehlan, 1973). Sharma and Sharma (2000) estimate stability of high yielding wheats at varying fertility levels.

Several authors studied the interpretation of observed interactions between genotypes and environments. Yates and Cochran (1939), Finlay and Wilkinson (1963), Eberhart and Russell (1966), Tai (1971) and others have proposed that where a number of genotypes tested, it should be regressed on the mean yield overall genotypes in each environment.

The purpose of the present investigation is to study stability parameters of green and dry forage yield in five varieties of ryegrass in pure stand and/or in mixture with Berseem at different seeding rates.

MATERIALS AN D METHODS

This study was conducted at Sakha, Gimmeza and Sids experimental stations in two successive seasons 1999/2000 and 2000/2001. Five introduced varieties of ryegrass (*Lolium multiflorum* L.) i.e Mt 380 Terwatco, Mt 337 Tewera, Mt 1465 Primora, Clipper and Caramba as well as Local variety of Berseem (Helali) were used in this investigation. Each variety of ryegrass was grown in pure stand at a rate of 15 Kg./Fed. As well as ryegrass was grown at the rates 6, 8 and 10 Kg./Fed in mixed with Berseem. Berseem was grown by 20Kg./Fed in case of the mixture.

Randomized complete block design with three replicates was used. Each replicate consistsed of 20 treatments (5 varieties x 4 seeding rates). The plot area was $6m^2$[E1]. The mixtures of Berseem and ryegrass were grown in alternative rows 20cm.apart. Other cultural practices were carried out as recommended. Stability parameters were conducted as suggested by Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Mean squares of environments, genotypes and genotype x environment interactions were highly significant for both green and dry forage yields (Table 1). Highly significant variances due to genotypes revealed the presence of large genetic variability for these traits. Highly significant mean squares for environments were detected indicating that the performances of these traits differed from one environment to another. As well as genotypes and environments interactions were highly significant, indicating that genotypes interacted with environmental conditions. The significance of genotype by environment interaction is in agreement with that of Jones and Mather (1958), Dangi *et al* (1980), Sharma *et al* (1984), Lodhi *et al* (1984)and Nawar *et al*.(1986).

Table (1): Combined analysis of variance for green And dry forage yield over environments.

S.V.	d.f.	Mean Squares	
		Green forage yield	Dry forage yield
Environments	23	3688.03 **	59.995 **
Reps within (E)	4 8	8.18 **	0.162 **
Genotypes	4	91.35 **	1.416 **
G X E	92	33.22 **	0.575 **
Pooled error	192	6.08	0.136

** Significant at 0.01 level of probability.

Results in table (2 and 3) showed the performance of five genotypes of ryegrass under 24 environments (4 seeding rates x 2 lcations x 2 years) for total green and dry foragge yield.

Table (2): Total green forage yield of five genotypes of ryegrass under 24 environments (4 seeding rates x 2 locations x 2 seasons).

Seasons	Locations	Environments	Genotypes					Over all Means
			Mt 380 Terwatco	Mt 337 Tewera	Mt 1465 Primora	Clipper	Caramba	
1999/2000	Sakha	(Env. 1) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	40.72	42.14	42.58	38.76	40.02	40.84
		(Env. 2) Ryegrass at rate 10 Kg./ Fed. in mixed.	63.75	66.38	68.09	69.58	64.47	66.45
		(Env. 3) Ryegrass at rate 8 Kg./ Fed. in mixed.	65.45	63.63	63.47	62.16	64.19	63.78
	Gemmeiza	(Env. 4) Ryegrass at rate 6 Kg./ Fed. in mixed.	63.44	63.89	64.91	63.51	62.04	63.56
		(Env. 5) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	27.98	32.48	29.66	32.43	32.29	30.97
		(Env. 6) Ryegrass at rate 10 Kg./ Fed. in mixed.	39.32	37.80	39.27	38.59	41.56	39.31
	Sids	(Env. 7) Ryegrass at rate 8 Kg./ Fed. in mixed.	40.81	40.34	37.47	39.55	41.30	39.90
		(Env. 8) Ryegrass at rate 6 Kg./ Fed. in mixed.	44.43	42.58	39.34	43.59	40.90	42.17
		(Env. 9) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	55.65	58.45	43.75	56.70	52.85	53.48
		(Env. 10) Ryegrass at rate 10 Kg./ Fed. in mixed.	80.15	89.95	80.50	87.85	82.78	84.25
2000/2001	Sakha	(Env. 11) Ryegrass at rate 8 Kg./ Fed. in mixed.	79.80	82.25	79.28	76.48	82.78	80.12
		(Env. 12) Ryegrass at rate 6 Kg./ Fed. in mixed.	79.28	86.10	83.48	74.73	86.63	82.04
		(Env. 13) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	39.01	38.20	38.31	35.86	37.52	37.78
		(Env. 14) Ryegrass at rate 10 Kg./ Fed. in mixed.	57.61	59.45	60.43	56.30	59.43	58.65
	Gemmeiza	(Env. 15) Ryegrass at rate 8 Kg./ Fed. in mixed.	59.64	59.76	60.76	58.29	59.64	59.62
		(Env. 16) Ryegrass at rate 6 Kg./ Fed. in mixed.	58.57	60.57	58.68	62.79	60.55	60.23
		(Env. 17) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	36.05	32.55	34.88	35.30	38.15	35.39
	Sids	(Env. 18) Ryegrass at rate 10 Kg./ Fed. in mixed.	43.49	39.11	33.84	39.32	42.10	39.57
		(Env. 19) Ryegrass at rate 8 Kg./ Fed. in mixed.	43.28	45.13	32.32	40.13	43.63	40.90
		(Env. 20) Ryegrass at rate 6 Kg./ Fed. in mixed.	40.37	43.33	36.05	41.42	43.40	40.91
		(Env. 21) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	61.25	51.63	35.00	56.00	54.08	51.59
		(Env. 22) Ryegrass at rate 10 Kg./ Fed. in mixed.	66.68	61.95	67.03	67.55	64.23	65.49
		(Env. 23) Ryegrass at rate 8 Kg./ Fed. in mixed.	68.95	65.45	64.40	65.98	63.88	65.73
		(Env. 24) Ryegrass at rate 6 Kg./ Fed. in mixed.	63.18	63.54	68.78	67.03	68.77	66.26
Means			54.95	55.28	52.59	54.58	55.30	54.54

L.S.D. at 0.05 Env. 2.100
L.S.D. at 0.05 G 0.811
L.S.D .at 0.05 Env. X G. 0.971

Table (3): Total green forage yield of five genotypes of ryegrass under 24 environments (4 seeding rates x 2 locations x 2 seasons).

Seasons	Locations	Environments	Genotypes					Over all Means
			Mt 380 Terwatco	Mt 337 Tewera	Mt 1465 Primora	Clipper	Caramba	
1999/2000	Sakha	(Env. 1) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	6.147	6.123	6.310	5.780	5.843	6.041
		(Env. 2) Ryegrass at rate 10 Kg./ Fed. in mixed.	8.987	9.287	9.623	9.813	9.027	9.347
		(Env. 3) Ryegrass at rate 8 Kg./ Fed. in mixed.	9.180	8.843	8.820	8.710	8.827	8.876
	Gemmeiza	(Env. 4) Ryegrass at rate 6 Kg./ Fed. in mixed.	8.740	8.720	8.930	8.763	8.447	8.720
		(Env. 5) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	4.150	4.833	4.500	4.807	4.823	4.623
		(Env. 6) Ryegrass at rate 10 Kg./ Fed. in mixed.	6.037	5.767	6.090	6.007	6.383	6.057
		(Env. 7) Ryegrass at rate 8 Kg./ Fed. in mixed.	6.310	6.220	5.810	6.270	6.323	6.187
	Sids	(Env. 8) Ryegrass at rate 6 Kg./ Fed. in mixed.	6.837	6.663	6.217	6.867	6.407	6.598
		(Env. 9) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	8.560	8.717	6.430	7.380	7.783	7.774
		(Env. 10) Ryegrass at rate 10 Kg./ Fed. in mixed.	12.030	11.930	11.097	12.533	11.943	11.907
2000/2001	Sakha	(Env. 11) Ryegrass at rate 8 Kg./ Fed. in mixed.	11.023	11.473	10.607	11.167	11.403	11.135
		(Env. 12) Ryegrass at rate 6 Kg./ Fed. in mixed.	11.070	11.797	12.463	10.990	12.317	11.727
		(Env. 13) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	5.167	5.080	5.097	4.813	5.100	5.051
		(Env. 14) Ryegrass at rate 10 Kg./ Fed. in mixed.	7.193	7.550	7.703	7.150	7.597	7.439
	Gemmeiza	(Env. 15) Ryegrass at rate 8 Kg./ Fed. in mixed.	7.490	7.507	7.737	7.290	7.550	7.515
		(Env. 16) Ryegrass at rate 6 Kg./ Fed. in mixed.	7.237	7.577	7.407	7.910	7.637	7.553
		(Env. 17) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	5.503	5.353	5.477	5.563	5.797	5.539
		(Env. 18) Ryegrass at rate 10 Kg./ Fed. in mixed.	6.410	6.000	5.070	6.097	6.007	5.917
	Sids	(Env. 19) Ryegrass at rate 8 Kg./ Fed. in mixed.	6.320	7.003	4.960	6.137	6.500	6.184
		(Env. 20) Ryegrass at rate 6 Kg./ Fed. in mixed.	5.917	6.663	5.437	6.280	6.600	6.179
		(Env. 21) Ryegrass at rate 15 Kg./ Fed. in Pure stand.	6.473	5.490	3.767	6.053	5.867	5.530
		(Env. 22) Ryegrass at rate 10 Kg./ Fed. in mixed.	7.640	6.913	7.533	7.597	7.267	7.390
		(Env. 23) Ryegrass at rate 8 Kg./ Fed. in mixed.	7.840	7.337	7.300	7.477	7.193	7.429
		(Env. 24) Ryegrass at rate 6 Kg./ Fed. in mixed.	7.010	7.047	7.757	7.660	7.503	7.395
Means			7.470	7.496	7.172	7.463	7.506	7.421

L.S.D. at 0.05 Env. 0.296
L.S.D. at 0.05 G 0.121
L.S.D at 0.05 Env. X G. 0.594

Conccerning the environmetal effect overall the cultivars, the data in Table 2 revealed that planting ryegrass with 10 Kg./Fed. in mixture at Sids St. gave the highest green yield (84.25 Ton/Fed.). On the contrast the plnnnting ryegrass at 15 Kg./Fed. in pure stand gave the lowest green yield (30.97Ton/Fed.) at Gemmeiza St. in 1999/2000 season.

Regarding the genotypes effect, the genotype Caramba gave the highest green yield (55.30 Ton/Fed.) over all the environments, but did not significantly differed than all other genotypes except the genotype Mt 1465 Primora.

With respect to the interaction between genotypes by years, the green yield ranged from 89.95 Ton/ Fed. when planting ryegrass (cv. Mt 337 Tewera) at rate 10 Kg./Fed. in mixture with Berseem.at Sids St. to 27.98 Ton / Fed. when planting ryegrass (cv. Mt 380 Terwatco) at rate 15 Kg./Fed. In pure stand at Gemmeiza St. in 1999/2000 season. The yield of cv. Mt 337 Tewera at rate 10 Kg./Fed. in mixture with Berseem.at Sids St. in the 1999/2000 was higher and significantly differed than all other genotypes with all othere environments interaction.

For dry forage yield in Table 3, the same trend was obtained for the environmeantal effect overall the cultivars, the data in Table 3 indicated that planting ryegrass with 10 Kg./Fed. in mixture at Sids St. gave the highest dry foragge yield (11.907 Ton/Fed.). While the plnnnting ryegrass at 15 Kg./Fed. in pure stand gave the lowest dry forage yield (4.623 Ton/Fed.) at Gemmeiza St. in 1999/2000 season.

Table (4): Analysis of variance for green and dry forage yield when stabilty parameters are estimated.

S.V.	d.f.	Mean squares	
		Green forage Yield	Dry forage yield
Total (GE-1)	119	24 7.19	40.2865
Genotypes (G-1)	4	30.45**	0.4719**
Env.+ G X E (G(E-1))	115	254.7305**	4.15236**
Environments (Linear)	1	28274.857**	459.96366**
G X E (G-1)	4	16.10075**	0.879425**
Pooled deviation (G(E-2))	110	8.6795**	0.12788**
Pooled error (E(R-1)(G-1))	192	2.025	0.045

** Significant at 0.01 level of probability.

Also, for the genotypes effect, the same trend obtained for dry forage yield in Table 3. The genotype Caramba gave the highest yield (7.506 Ton/Fed.) over all the environments, but did not significantly differed than all other genotypes except the genotype Mt 1465 Primora.

Regarding to the interaction between genotypes by years, the dry forage yield ranged from 12.533 Ton/ Fed. when planting ryegrass (cv. Clipper) at rate 10 Kg./Fed. in mixture with Berseem.at Sids St. to 4.150 Ton/ Fed. when planting ryegrass (cv. Mt 380 Terwatco) at rate 15 Kg./Fed. in pure stand at Gemmeiza St. in 1999/2000 season. The yield of cv. Mt 337 Tewera at rate 10 Kg./Fed. in mixture with Berseem.at Sids St. in the

1999/2000 was higher than all other genotypes with all othere environments interaction.

The linear response of environment as well as the pooled deviation (Table 4), were highly significant for both characters, therefore, the regression coefficient (b_i) and deviation from regression mean squares (S^2d_i) pooled over all environments were calculated for each genotype and presented in Table 5.

Table(5): Mean values and stability parameters for green and dry forage yield.

Genotypes	Green forage yield			Dry forage yield		
	X Ton/fed.	B_I	S^2d_I	X Ton/fed.	B_I	S^2d_I
Mt 380 Terwatco	54.952	0.9389	5.696*	7.470	0.955	0.0700
Mt 337 Tewera	55.277	1.0328	3.308*	7.496	1.004	0.0349
Mt 1465 Primora	52.594	1.0671	17.978*	7.172	1.063	0.2958*
Clipper	54.579	0.9814	4.821*	7.463	0.993	0.0286
Caramba	55.299	5.0078*	1.469*	7.506	0.9992	-0.0153
General Mean	54.540	1.8058	6.654	7.421	1.0029	0.0889
Standerd error	0.300	0.039	0.367	0.044	0.0373	0.037

For green forage yield, four-genotypes i.e. Mt380 Terwatco, Mt 337 Tewera, Clipper and Caramba performed better than the average performance. Only these genotypes could be of some use to the breeders because the genotypes with below average performances are of little practical utility even if they are stable. Regression coefficient ($_{bi}$) was nonsignificant for all genotypes except Caramba. (Dangi *et al* 1980) stated that the environmental condition had effective on the response of genotypes. Four genotypes i.e. Mt 380 Terwatco, Mt 337 Tewera, Mt 1465 Primora and Clipper possessed b values equal to one. Therefore, the above genotypes were averages responsive to changes in environments and could perform well under average environmental conditions. All genotypes showed significant trend for non-linearity and therefore were unstable for this character.

For dry forage yield, also the same four genotypes i.e. Mt380 Terwatco, Mt 337 Tewera, Clipper and Caramba performed better than the average performance. So, these genotypes could be of some use to the breeders. Considered the response of genotypes to change in environmental conditions. All the genotypes had a regression coefficient equal to one. Nonsiginificant values of S^2d_i revealed better stability for all genotypes except Mt 1465 Primora for this trait, which indicated that prediction of the performances was possible in case of majority of genotypes.

On the basis of all the parameters, it was quite clear that the high yield, response and better stability, the four genotypes i.e. Caramba, Mt 337 Tewera, Mt380 Terwatco and Clipper were most promising. Practical utility for forage production under both poor and good management conditions and these could be used as a stable and high yielding genotypes in breeding programs.

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دراسة الثبات لمحصول العلف الأخضر والجاف فى الراى جراس

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أجرى هذا البحث بهدف تقدير مقدار الثبات لمحصول العلف الأخضر والجاف لعدد خمسة تراكيب وراثية مستوردة من الجازون (الراي جراس) فى المحطات البحثية سدس ، الجميزة ، سخا خلال الموسمين المتتالين 2000/1999، 2001/2000.

وقدرت ثوابت الاقلمة وتتلخص النتائج المتحصل عليها فى الاتي:

- كان التباين الراجع الي الاصناف والبيئات والتفاعل بينهم معنويا.
- اعطت جميع زراعات مخلوط البرسيم مع الراى جراس اعلىانتاجيه من محصول العلف الأخضر و الجاف مقارنه بالزراعه المنفردة للراى جراس وخاصه عندما كان معدل الراى جراس عشرة كيلو جرام للفدان فى المخلوط فى محطه بحوث سدس فى الموسم 2000/1999
- أعطى التركيب الوراثى كرامبا أعلى إنتاجية من العلف الأخضر والجاف.
- كان معامل الانحدار معنوي لجميع التراكيب الوراثية لكلا الصفتين بإستثناء التركيب الوراثى كرمبا لصفة محصول العلف الاخضر.
- أظهرت كل التراكيب الوراثية معنويتها بالنسبة لانحرافها عن خط الانحدار فى صفة محصول العلف الاخضر وكذلك التركيب الوراثى بريمورا 1465 بالنسبة لصفة العلف الجاف0
- كانت أعلى التراكيب الوراثية من حيث الإنتاجية والاكثر ثباتاً والمبشرة والتى يمكن إستخدامها فى برامج التربية هى كرامبا ، تيورا 337، تروانكو 380، كليبر0