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Stability assessment in tomato (*Solanum lycopersicum* L.)

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Abstract
The experimental materials consisting of nine genotypes and their resultant 36 F1 hybrids with one commercial check (Abhinav) were tested in three different environments during late *kharif* to *summer* 2015-16 creating three different environments. Analysis of variance for stability revealed that the differences among genotypes and environments were highly significant for all the characters when tested against pooled error and pooled deviation. Parent AVTO-7; and hybrids AVTO-7 x JTL-12-08 followed by JTL-13-20 x AVTO-6 and AT-3 x Arka Abha were considered as the most stable genotypes for fruit yield per plant.

Keywords: Stability assessment, *Solanum lycopersicum*, experimental, commercial, environments

Introduction
Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable crops widely grown all over the world. It is a self-pollinated crop and is a member of *Solanaceae* family. Great fluctuations in the yield are observed due to the non-adaptability of varieties to variable agro-climatic conditions. The major objective of any plant breeding and selection programme is to develop genotypes, which could perform consistently superior in many variables environment. Multi-environment trials are conducted to evaluate yield stability performance of genetic materials under varying environmental conditions (Yan and Rajcan, 2002) [12]. The relative performance of genotypes for quantitative characteristics such as yield and other characteristics, which influence yield, vary from an environment to another. Consequently, to develop a genotype with high yielding ability and consistency, high attention should be given to the importance of stable performance for the genotypes under different environments and their interactions which had important bearing on breeding for better varieties buffering (Allard and Bradshow, 1964) [2]. Kang (1998) [7] mentioned that gene expression is subject to modification by the environment; therefore, genotypic expression of a phenotype is environmentally dependent. Stability in performance of a genotype over a wide range of environments is a desirable attribute and depends largely upon magnitude of genotype-environment interaction (Ahmad *et al*., 1996) [1]. For stabilizing yield, it is necessary to identify the stable genotypes suitable for a wide range of environments.
It was, therefore, felt necessary to study the stability behaviour of newly developed tomato varieties/ hybrids (referred as genotypes in this investigation) and their performance under varying plant bio-regulator regimes.

Materials and Methods
The experimental material consisted of 36 hybrids which obtained from nine parental line through half diallel, along with one commercial check (Abhinav). The genotypes were tested during Oct-2015, Nov-15 and Dec-2015 which conducted during late *kharif* to *summer* 2015-16, at Regional horticulture Research Station, ASPEE college of Horticulture and Forestry, N.A.U., Navsari. These three transplanting date were treated as three environments in stability analysis. The experiments were carried out in Randomized Block Design, with three replications. Spacing between rows and plants was 90 and 60cm, respectively. Data were recorded on five randomly selected plants for days to 50% flowering, days to first picking, days to last picking, plant height, number of branches per plant, number of fruits per plant, average fruit weight, fruit yield per plant, fruit polar diameter, fruit equatorial diameter, fruit pericarp thickness and number of locules per fruit. The data were subjected to Analysis of

Variance to test the significance of Genotype x Environment interactions. Stability parameters, regression (bi) and deviation from regression (S^2di) were worked out by the method of Eberhart and Russel (1966) [5].

Result and Discussion

The mean sums of squares due to genotypes were significant to highly significant for all the characters when tested against pooled deviation. Significant to highly significant differences were also observed amongst environments for all the characters when tested against pooled deviation. The genotype x environments interaction was highly significant for all characters except days to 50 per cent flowering, days to first picking, fruit polar diameter (cm), fruit equatorial diameter (cm) and number of locules per fruit when tested against pooled deviation. The lack of significant G x E interactions for these characters indicated that genotypes responded consistently over the environments. There is no need to test these characters further. The mean sum of squares due to environment (linear) was significant to highly significant for all characters when tested against pooled deviation.

urther the mean sum of squares due to genotypes x environments (linear) component significance to highly significant for all the characters except days to 50 % flowering, days to first picking, fruit polar diameter (cm), fruit equatorial diameter (cm) and fruit pericarp thickness (mm) when tested against pooled deviations. Thus, linear effects played an important role as compared to non-linear effects in the development of these characters. On the other side, pooled deviation (unpredictable) contributed slightly more to the total characters for reducing sugar. Thus, this study indicated that both linear and non-linear functions play an important role in building up total G x E interaction. These findings are in agreement with those of Prasanna *et al*. (2007) [8], Ummyiah *et al*. (2015) [11].

To assess the stability of a genotype, linear regression can be regarded as a major response of that particular genotype, and deviation from regression should be considered as a better measure of stability (Jatasra and Paroda, 1979 and Beeker, 1981) [6, 3]. Hence, mean performance of the genotype, together with regression co-efficient (bi) and deviation from regression (S2di) are discussed here (Table 2 a, b & c.).

In the present investigation, hybrids showed better performance than the corresponding parents. The probable reason is that the, hybrid have broader genetic base as compared to parents which increase the adoptability of hybrids. Similar results have been reported by Dhaduk *et al*., 2004 [4] and Ummyiah *et al*., 2015 [11].

Among the parents, JTL-08-16 registered high mean value, low S^2d_i values with b_i value nearer to unity for plant height and number of fruits per plant whereas JTL-13-20 and AVTO-6 exhibited high mean value, low S^2d_i values with b_i value nearer to unity for average fruit weight and pericarp thickness, respectively. While JTL-12-08 (b_i=0.94$^+$) and JTL-12-11 (b_i=1.12^{++}) registered high mean value, low S^2d_i values with significant b_i value nearer to unity while, AVTO-7 (b_i=1.04) exhibited higher mean value with low S^2d_i and b_i value nearer to one.

Among hybrids, JTL-08-16x Arka Abha (b_i=0.94) and JTL-12-08 x JTL-12-12 (b_i=1.09) registered high mean value, b_i value around unity and lower S^2d_i for days to first picking. For plant height, JTL-12-08 x JTL-12-11 (b_i=1.15), JTL-12-08 x AVTO-6 (b_i=1.08), JTL-12-12 x JTL-08-16 (b_i=1.02) and JTL-12-11 x JTL-08-16 (b_i=1.12) registered higher mean values, low deviation from regression values with b_i value nearer to unity. In case of number of fruits per plant, hybrid combinations *viz*., JTL-13-20 x AVTO-6 (b_i=0.91^{++}), JTL-13-20 x Arka Abha (b_i=1.12^{++}) and JTL-12-12 x Arka Abha (b_i=1.13^{++}) exhibited higher mean value with low S^2d_i and significant b_i value nearer to unity and AVTO-7 x JTL-12-12 (b_i=0.93) and JTL-13-20 x AVTO-6 (b_i=1.16) registered higher mean values, low deviation from regression values and regression coefficients value nearer to one for average fruit weight. While, AVTO-7 x JTL-13-20 (b_i=1.07), JTL-12-12 x JTL-08-16 (b_i=0.91), JTL-12-08 x JTL-12-12 (b_i=1.03) and JTL-13-20 x Arka Abha (b_i=1.19) registered high mean value, low S^2d_i values with b_i value nearer to unity for pericarp thickness.

For parental strains *viz*., JTL-12-08 (3.10), JTL-08-16 (2.91), JTL-12-11 (2.76) and AVTO-7 (2.67) and 17 hybrids had higher mean values for fruit yield than the grand mean 2.58 for parents and 3.27 for hybrids.

These genotypes were presented for further testing for their stability by regression coefficients (bi) on environments. Value of 1.00 for bi indicates average responsiveness. None of the test genotypes were characterized as above responsive (b_i > 1.00). The another group of genotypes having average response (bi nearly equal to one) for fruit yield includes AVTO-7 (b_i= 1.04), AVTO-7 x JTL-12-08 (b_i=0.97), AT-3 x Arka Abha (b_i =1.00) and JTL-13-20 x AVTO-6 (b_i=1.00). Thus, the latter group having bi value nearly equal to one was less responsive than the former group having bi value slightly higher than one.

To further isolate a stable genotype, another stability parameter, the deviation from regression was used. The lesser the magnitude of S2di, the more is the stability. By this standard, parent AVTO-7; and hybrids AVTO-7 x JTL-12-08 followed by JTL-13-20 x AVTO-6 and AT-3 x Arka Abha were considered as the most stable genotypes.

The information about stability and contribution of different characters of interest will be useful in selecting parents for hybridization. Hybridization may be initiated to generate wide spectrum of variability so that breeder can manipulate the material. At the same time, the promising genotype/ hybrids can be evaluated in larger plots and recommended for release.

Table 1: Analysis of variance for phenotypic stability pertaining to various characters in tomato.

	Characters						
Source	**d.f.**	**Days to 50 per cent flowering**	**Days to first picking**	**Days to last picking**	**Plant height (cm)**	**Number of branches per plant**	**Number of fruits per plant**
Genotypes (G)	45	19.12 ** ++	52.78**++	6.53**++	264.83**++	7.32**++	107.43**++
Environments (E)	2	4.69**++	16.99**++	106.34**++	121.53**++	60.02**++	479.37**++
G X E	90	0.63*	3.04	3.75*+	1.01++	0.28**++	2.45**++
Environments (linear)	1	9.39**++	33.98**++	212.69**++	243.07**++	120.04**++	958.74**++
G X E (linear)	45	0.65	3.77*	5.12**++	1.54++	0.39**++	3.92**++

Pooled deviation	46	0.6	2.56	2.34	0.48	0.16	0.96
Pooled error	270	0.53	2.44	2.8	9.06	0.18	1.83
CHARACTERS							
Source	d.f.	Average fruit weight (g)	Fruit yield per plant (kg)	Fruit polar diameter (cm)	Fruit equatorial diameter (cm)	Fruit pericarp thickness (mm)	Number of locules per fruit
Genotypes (G)	45	364.16**++	0.74**++	1.25**++	2.1**++	4.29**++	3.62**++
Environments (E)	2	290.4**++	6.29**++	0.01++	0.02**++	0.03**++	0.04++
G X E	90	1.89**++	0.02**++	0.0004	0.0001	0.0003**++	0.001
Environments (linear)	1	580.8**++	12.59**++	0.02++	0.036++	0.05**++	0.09*++
G X E (linear)	45	2.77++	0.03*++	0.0002	0.0001	0.001**	0.002++
Pooled deviation	46	0.99	0.01	0.001	0.0001	0.0001	0.001
Pooled error	270	4.01	0.02	0.01	0.013	0.004	0.02

Table 2: Stability parameters of individual genotype for days to last picking and plant height (cm)

Sr. No.	Genotype	Days to last picking					Plant height (cm)				
		Mean	b_i	b_i=0	b_i=1	S^2di	Mean	b_i	b_i=0	b_i=1	S^2di
Parents											
1	AVTO-7	146.40	2.00	**		0.30	99.68	0.88	**		-8.60
2	JTL-12-08	148.80	2.24	**		-2.70	101.8	0.85	**		-8.05
3	JTL-12-12	148.90	0.09			-1.40	99.86	1.59	**		-6.48
4	JTL-12-11	147.30	-0.09			-2.20	85.27	0.73	**	++	-8.82
5	AT-3	147.90	1.94	**		0.30	84.95	2.01	**	++	-8.50
6	JTL-08-16	150.00	1.85			9.60*	104.99	1.25	**		-8.69
7	JTL-13-20	149.60	-0.09			4.80	76.40	0.82	**	+	-8.83
8	AVTO-6	149.00	0.03			0.10	108.34	0.54	**	++	-8.74
9	Arka Abha	146.60	1.61	*		2.20	98.87	1.99	**	++	-8.86
	Mean	**148.28**					**95.57**				
Hybrids											
10	AVTO-7 x JTL-12-08	148.10	0.55			1.70	96.84	1.34	*		-6.00
11	AVTO-7 x JTL-12-12	147.60	2.49	*		6.40	108.39	0.94	*		-7.21
12	AVTO-7 x JTL-12-11	149.90	0.76	**	+	-2.70	104.99	-0.14			-8.74
13	AVTO-7 x AT-3	148.90	2.06	**		-2.60	101.01	0.99	**		-8.84
14	AVTO-7 x JTL-08-16	150.30	1.55	**		0.20	110.26	2.24	**	++	-7.75
15	AVTO-7 x JTL-13-20	149.00	2.15	*		6.70	93.98	1.13	**		-8.50
16	AVTO-7 x AVTO-6	150.10	2.27	**		-1.30	88.38	0.90	**		-8.86
17	AVTO-7 x Arka Abha	149.60	2.97	**		2.80	100.44	0.51	**	++	-8.88
18	JTL-12-08 x JTL-12-12	149.60	1.09	*		-1.10	102.68	1.05	**		-8.40
19	JTL-12-08 x JTL-12-11	150.30	0.27			-2.50	86.39	1.48	**	++	-8.85
20	JTL-12-08 x AT-3	146.90	-0.25	*	++	-2.80	100.15	0.47	**	++	-8.79
21	JTL-12-08 x JTL-08-16	148.60	1.39	**		-2.40	99.13	0.53	**	++	-8.86
22	JTL-12-08 x JTL-13-20	147.40	-0.12			-2.80	84.95	1.06	**		-8.77
23	JTL-12-08 x AVTO-6	147.40	1.49	**		-1.40	103.58	1.65	**	++	-8.83
24	JTL-12-08 x Arka Abha	147.10	-0.49	**	++	-2.70	105.92	1.35	**		-8.48
25	JTL-12-12 x JTL-12-11	147.90	-1.34	**		-2.10	107.93	0.30	**	++	-8.86
26	JTL-12-12 x AT-3	148.90	2.37	**		-1.70	86.21	0.37	**	++	-8.73
27	JTL-12-12 x JTL-08-16	150.60	0.40	**	++	-2.50	107.93	1.69	**	++	-8.88
28	JTL-12-12 x JTL-13-20	148.10	-0.52			-0.40	84.34	0.93	**		-8.83
29	JTL-12-12 x AVTO-6	146.70	2.64	**		3.00	110.79	1.50	*		-3.11
30	JTL-12-12 x Arka Abha	149.70	3.00	**		4.10	100.38	1.79	**	++	-8.84
31	JTL-12-11 x AT-3	146.60	-0.49			-1.10	85.56	1.09	**		-8.27
32	JTL-12-11 x JTL-08-16	152.00	1.91	**		1.00	93.51	0.81	**		-8.47
33	JTL-12-11 x JTL-13-20	149.10	0.42			-1.30	87.39	1.11	**		-8.79
34	JTL-12-11 x AVTO-6	148.40	0.30	**	++	-2.70	93.97	1.35	**	++	-8.83
35	JTL-12-11 x Arka Abha	150.70	1.45	**		-1.90	90.62	0.99	**		-8.84
36	AT-3 x JTL-08-16	152.20	1.12	**		-2.80	93.40	0.39	**	++	-8.88
37	AT-3 x JTL-13-20	149.40	0.58			-2.00	86.15	1.76	**	++	-8.85
38	AT-3 x AVTO-6	150.60	1.33	**		-2.70	98.11	0.75	**		-8.11
39	AT-3 x Arka Abha	147.40	-0.00			-1.80	93.81	0.52	**		-8.52
40	JTL-08-16 x JTL-13-20	150.30	0.61			-0.30	104.11	1.59	**	+	-8.14
41	JTL-08-16 x AVTO-6	152.00	1.76	**		-0.20	110.43	0.56	**	++	-8.85
42	JTL-08-16 x Arka Abha	150.00	0.94	**		-2.60	103.07	0.29	**	++	-8.87
43	JTL-13-20 x AVTO-6	149.40	0.15			-2.40	84.33	0.20	**	++	-8.88
44	JTL-13-20 x Arka Abha	148.00	0.48	*	+	-2.30	82.20	0.53	**	++	-8.85
45	AVTO-6 x Arka Abha	149.90	0.24			-2.10	107.48	0.85	**		-8.69
46	Abhinav	149.60	0.79	*		-1.80	111.91	0.48			-8.28
	Mean	**149.14**					**97.59**				

Table 3: Stability parameters of individual genotype for number of branches per plant and number of fruits per plant

Sr. No.	Genotype	Number of branches per plant					Number of fruits per plant				
		Mean	b_i	b_i=0	b_i=1	S^2di	Mean	b_i	b_i=0	b_i=1	S^2di
Parents											
1	AVTO-7	9.87	0.89	**	+	-0.16	29.09	0.75	**		-1.29
2	JTL-12-08	12.36	1.19	**		-0.07	30.60	0.73	**	++	-1.80
3	JTL-12-12	10.71	1.02	**	+	-0.18	29.18	0.81	**	++	-1.76
4	JTL-12-11	12.16	0.98	*		0.98 *	30.23	0.91	**		-0.35
5	AT-3	10.31	1.52	**	++	-0.18	28.27	0.81	**		-1.09
6	JTL-08-16	12.64	0.95	**		-0.17	32.47	0.91	**		-1.37
7	JTL-13-20	11.53	0.49	**	++	-0.15	27.52	1.29	**		-1.04
8	AVTO-6	12.49	0.64	*		0.50	25.21	0.48	**	++	-1.76
9	Arka Abha	17.18	1.61	**	++	-0.12	41.96	0.97	**	++	-1.80
	Mean	**12.14**					**30.50**				
Hybrids											
10	AVTO-7 x JTL-12-08	12.40	0.89	**	+	-0.16	37.50	0.70	**	++	-1.80
11	AVTO-7 x JTL-12-12	12.58	1.31	**	++	-0.18	37.32	1.27	**	++	-1.76
12	AVTO-7 x JTL-12-11	11.80	1.75	**	++	-0.18	36.98	0.93	**		-1.74
13	AVTO-7 x AT-3	10.33	1.44	**	++	-0.06	29.33	0.38		++	-0.95
14	AVTO-7 x JTL-08-16	13.42	1.61	**	++	-0.18	42.09	1.30	**	++	-1.80
15	AVTO-7 x JTL-13-20	11.38	0.40	**	++	-0.18	26.60	0.67	**	++	-1.80
16	AVTO-7 x AVTO-6	9.07	1.07	**		-0.17	27.08	0.12			4.55
17	AVTO-7 x Arka Abha	11.56	0.70	**		0.06	26.52	0.46	**	++	-1.74
18	JTL-12-08 x JTL-12-12	10.73	0.82	**		-0.05	32.51	0.69	**	++	-1.75
19	JTL-12-08 x JTL-12-11	13.73	1.15	**		-0.08	36.89	1.48	**	++	-1.80
20	JTL-12-08 x AT-3	10.84	1.18	**		-0.07	26.31	0.67	**	++	-1.80
21	JTL-12-08 x JTL-08-16	10.04	0.99	**		-0.12	21.01	0.75	**	++	-1.80
22	JTL-12-08 x JTL-13-20	11.80	0.42	*	++	0.05	35.96	1.00	**		-0.64
23	JTL-12-08 x AVTO-6	13.58	1.08	**		-0.09	44.58	1.89*	**	++	-1.72
24	JTL-12-08 x Arka Abha	14.00	0.81	**		0.31	39.69	0.61			0.90
25	JTL-12-12 x JTL-12-11	11.80	0.84	**	++	-0.17	30.07	0.66	**	++	-1.75
26	JTL-12-12 x AT-3	11.91	0.84	**		-0.12	25.76	0.49	**	++	-1.80
27	JTL-12-12 x JTL-08-16	12.17	1.02	*		1.18**	35.49	0.99	**		-1.06
28	JTL-12-12 x JTL-13-20	13.49	1.31	**	+	-0.04	40.57	1.43	**		-0.06
29	JTL-12-12 x AVTO-6	11.40	0.48	**	++	-0.12	22.88	0.94	**		-1.71
30	JTL-12-12 x Arka Abha	14.87	1.36	**	++	-0.17	45.88	1.13	**	++	-1.80
31	JTL-12-11 x AT-3	10.53	1.56	**	++	-0.18	37.35	1.28	**	++	-1.77
32	JTL-12-11 x JTL-08-16	12.09	1.12	**		0.24	31.80	0.96	**	++	-1.80
33	JTL-12-11 x JTL-13-20	11.78	0.03	**	++	-0.18	25.07	0.42	**	++	-1.27
34	JTL-12-11 x AVTO-6	12.31	1.24	**		0.13	26.49	1.07	**		-1.24
35	JTL-12-11 x Arka Abha	14.18	1.48	**	++	-0.18	38.40	1.42	**		-0.36
36	AT-3 x JTL-08-16	11.76	0.84	**	++	-0.18	33.67	0.44			8.39 *
37	AT-3 x JTL-13-20	9.84	1.07	**	++	-0.18	34.66	1.71	**	+	0.27
38	AT-3 x AVTO-6	9.36	0.76	**	++	-0.12	33.67	1.58	**		2.59
39	AT-3 x Arka Abha	14.53	1.64	**		-0.18	43.37	1.39	**		-0.26
40	JTL-08-16 x JTL-13-20	11.38	0.42	**	++	-0.14	33.49	1.47	**		2.68
41	JTL-08-16 x AVTO-6	11.87	0.83	**	++	-0.18	35.39	2.09	**	++	-1.45
42	JTL-08-16 x Arka Abha	13.33	0.49			0.86 *	38.70	1.76	**	++	-1.47
43	JTL-13-20 x AVTO-6	11.53	1.27	**	++	-0.16	34.73	0.91	**	++	-1.80
44	JTL-13-20 x Arka Abha	11.91	0.63	**	++	-0.14	36.32	1.12	**	++	-1.80
45	AVTO-6 x Arka Abha	11.02	0.78	**	++	-0.18	35.2	1.35	**	++	-1.75
46	Abhinav	13.67	1.10	**		-0.15	32.82	0.85	**	++	-1.80
	Mean	12.00					33.84				

Table 4: Stability parameters of individual genotype for titrable acidity (%), ascorbic acid(mg /100 g) and non reducing sugar (%)

Sr. No.	Genotype	Average fruit weight (g)					Fruit yield per plant (kg)					Fruit pericarp thickness (mm)				
		Mean	b_i	b_i=0	b_i=1	S^2di	Mean	b_i	b_i=0	b_i=1	S^2di	Mean	b_i	b_i=0	b_i=1	S^2di
Parents																
1	AVTO-7	82.54	1.77	**	+	-2.40	2.67	1.04	**		-0.019	3.10	1.34			-0.004
2	JTL-12-08	92.43	1.25	**		-3.42	3.10	0.94	**	+	-0.017	2.93	0.71			-0.004
3	JTL-12-12	73.30	1.02	**		-3.89	2.40	0.82	**		-0.019	3.86	0.52	**	++	-0.004
4	JTL-12-11	82.47	1.61	**	++	-3.74	2.76	1.12	**	++	-0.014	5.10	0.87			-0.004
5	AT-3	74.01	0.86	**		-3.19	2.35	0.82	**	++	-0.016	2.55	0.83			-0.004
6	JTL-08-16	82.03	1.92	**		-0.94	2.91	1.35	**	++	-0.018	3.97	0.87			-0.004
7	JTL-13-20	81.26	0.92	**		-3.25	2.50	1.23	**	++	-0.019	2.63	0.71			-0.004
8	AVTO-6	78.18	1.64	**		1.02	2.23	0.72	**	++	-0.014	4.62	1.03			-0.004
9	Arka Abha	48.56	0.87	**	++	-3.95	2.30	0.78	**	++	-0.019	3.14	1.11	**	++	-0.004
	Mean	**77.20**					**2.58**					**3.54**				

Hybrids																
10	AVTO-7 x JTL-12-08	90.34	1.56	**	++	-3.69	3.81	0.97	**		-0.019	5.24	0.23	**	++	-0.004
11	AVTO-7 x JTL-12-12	86.67	0.93	**		-3.27	3.7	1.35	**	++	-0.019	6.12	2.34	**	++	-0.003
12	AVTO-7 x JTL-12-11	73.70	0.84	**		-3.58	3.13	0.77	**	++	-0.018	3.09	4.14	**	++	-0.003
13	AVTO-7 x AT-3	88.95	1.75	**	++	-3.95	2.98	0.54	**	++	-0.018	5.11	0.83			-0.004
14	AVTO-7 x JTL-08-16	64.25	0.65	**	+	-3.63	3.11	0.86	**	++	-0.019	4.70	1.22	**	++	-0.004
15	AVTO-7 x JTL-13-20	101.22	0.89			-1.11	3.1	0.72	**	++	-0.013	6.56	1.07			-0.004
16	AVTO-7 x AVTO-6	89.17	0.70	**	++	-3.97	2.8	0.27	*	++	0.022	2.50	0.79	**	++	-0.004
17	AVTO-7 x Arka Abha	99.43	0.23			-2.92	3.04	0.55	**		-0.019	4.25	0.67	**	++	-0.004
18	JTL-12-08 x JTL-12-12	100.81	0.17	**	++	-3.93	3.67	0.76	**	++	-0.015	4.36	1.03	**		-0.003
19	JTL-12-08 x JTL-12-11	84.03	0.21			-3.29	3.51	1.15	**	++	-0.015	2.72	1.11	**	++	-0.004
20	JTL-12-08 x AT-3	86.14	1.41	*		1.21	2.68	0.80	**	++	-0.017	4.69	0.98	**		-0.003
21	JTL-12-08 x JTL-08-16	104.11	0.53			0.01	2.6	0.78	**	++	-0.012	3.66	0.71			-0.004
22	JTL-12-08 x JTL-13-20	66.18	0.71	**		-3.58	2.78	0.68	**	++	-0.013	2.08	2.92	**		-0.004
23	JTL-12-08 x AVTO-6	80.56	0.75	*		-2.34	3.79	1.25	**		0.104*	5.34	0.51	**	++	-0.004
24	JTL-12-08 x Arka Abha	88.15	2.33	**	+	0.65	3.8	0.90	**		-0.013	3.65	1.03			-0.004
25	JTL-12-12 x JTL-12-11	76.69	0.94	**		-3.64	2.72	0.61	**	++	-0.019	3.94	1.34			-0.004
26	JTL-12-12 x AT-3	102.33	1.25	*		-0.46	3.04	0.68	**	++	-0.016	2.14	0.67			-0.004
27	JTL-12-12 x JTL-08-16	75.01	0.57	**	++	-3.63	3.08	0.79	**	++	-0.017	3.95	0.91			-0.004
28	JTL-12-12 x JTL-13-20	80.28	1.02	**		-3.37	3.65	1.25	**	++	-0.016	3.33	0.87			-0.004
29	JTL-12-12 x AVTO-6	93.40	1.03	**		-3.83	2.5	1.01	**		-0.005	4.82	1.23	**	++	-0.004
30	JTL-12-12 x Arka Abha	72.36	0.48	**	++	-3.90	3.73	0.87	**	++	-0.018	1.96	1.22	**	++	-0.004
31	JTL-12-11 x AT-3	94.88	1.16	**	++	-3.95	3.97	1.34	**	++	-0.015	4.50	1.38	**		-0.004
32	JTL-12-11 x JTL-08-16	86.38	1.46	**	++	-3.90	3.16	1.06	**	++	-0.019	4.01	0.55	**	++	-0.003
33	JTL-12-11 x JTL-13-20	73.10	0.96	**		-2.46	2.24	0.50	**	++	-0.010	3.42	0.28			-0.004
34	JTL-12-11 x AVTO-6	83.97	0.83	**	++	-3.93	2.63	0.94	**	++	-0.019	1.36	0.99			-0.004
35	JTL-12-11 x Arka Abha	75.38	1.00	**		-3.97	3.31	1.17	**	+	-0.003	2.46	0.91			-0.004
36	AT-3 x JTL-08-16	82.29	0.51	**	++	-3.97	3.34	0.88	**	++	-0.017	3.15	0.27	**	++	-0.003
37	AT-3 x JTL-13-20	97.33	1.55	**		-1.24	3.65	1.57	**	++	0.029	2.26	0.23	**	++	-0.004
38	AT-3 x AVTO-6	85.91	0.90	**	++	-3.97	3.34	1.60	**	++	0.009	3.97	1.22	**	++	-0.004
39	AT-3 x Arka Abha	72.54	0.61	**	++	-3.88	3.51	1.00	**		-0.019	4.86	0.27	**	++	-0.003
40	JTL-08-16 x JTL-13-20	76.54	1.03	**		-3.94	3.07	1.56	**	++	0.046	4.13	0.55			-0.004
41	JTL-08-16 x AVTO-6	92.02	0.43			-3.21	3.71	1.83	**	++	-0.013	2.36	0.52	**	++	-0.004
42	JTL-08-16 x Arka Abha	82.34	0.63	**	++	-3.87	3.63	1.54	**	++	-0.019	4.37	0.32			-0.004
43	JTL-13-20 x AVTO-6	89.54	1.16	**		-3.45	3.52	1.00	**		-0.018	3.65	1.19			-0.004
44	JTL-13-20 x Arka Abha	75.87	0.77	**	++	-3.91	3.17	0.94	**		-0.019	4.22	1.19			-0.004
45	AVTO-6 x Arka Abha	92.72	1.40	**		-3.46	3.69	1.40	**	++	-0.011	5.21	1.11	**	++	-0.004
46	Abhinav	92.42	0.81	**	++	-3.96	3.68	1.35	**	++	-0.019	6.07	1.19	**	++	-0.004
	Mean	85.32					3.27					3.90				

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