Original Research Article

Response of Fenugreek (*Trigonella foenum-graecum* L.) Genotypes for their germination and early Seedling parameters Grown Under different Saline levels

Abstract

Seedling establishment is a most critical stage that determined the crop production at later stages. An *in vitro* investigation was carried out at the Laboratory of the Department of Plant Breeding and Genetics, Sri Karan Narendra College of Agriculture, Jobner (Rajasthan) in *Rabi* season 2016-17 to study the response of fenugreek genotypes for their germination and early seedling parameters under five salt stress levels *viz.* 0.0 mM, 40 mM, 80 mM, 120 mM and 160 mM. Fifteen seeds of each genotype were sown in sterilized Petridish and seedling observations were recorded. Results revealed that the average value was found maximum in the control and minimum at higher salinity level for most of traits. Higher reduction was found at higher salinity levels for most of the characters viz., plumule length, radicle length, seedling length, plumule to radicle length ratio, plumule fresh weight, radicle fresh weight, plumule dry weight, radicle dry weight and seedling vigour index but germination percentage showed less reduction. The contrast between mean of various genotypes in control conditions (S_0) versus S_m (mean of S_1, S_2, S_3 and S_4) for each character also showed that overall mean was highest in control as compared to the overall mean of salinity levels for all the traits. This investigation concluded that higher level of salinity (above 60 mM) adversely most affected to seed germination and other early seeding traits rather than (below 40 mM) lower salinity levels. Based upon the rank totals of genotype over different salinity levels S_1, S_2, S_3 and S_4 (S_m) and characters, the RMt-303 was found to be most desirable genotype followed by UM-385, RMt-143 and RMt-305. These lines would be used as a viable option under saline conditions and better exploit in hybridization programme.

Key Words: Fenugreek, salinity, effect of salt, seed germination and early seedling traits.

Abbreviation: S0 Control level, S1 salinity level 1, S2 salinity level 2, S3 salinity level 3, S4 salinity level 4, Sm- overall mean of the various salinity levels.

1. Introduction:

Salinity is one of the major abiotic stresses present in irrigation water in arid and semi-arid regions that affects the grain yield by limiting the growth and dry matter production. It is estimated that 6 percent of the world´s total land and 20 per cent of the world´s irrigated areas are affected by salinity. Environmental stress including salinity can cause about 50% of production losses (Acquaah, 2007) {1}. Furthermore, the continuous increase in the human population put pressure on global food security as the world's food supply needs to be increased by up to 70% by 2050 (FAO. 2009) {7}. Salinity refers conditions have soluble salts in waters. Salinity can be defined as the soil paste extract whose electrical conductivity is greater than 4 ds/m, ESP is less than 15% and pH is lower than 8.5. Germination is one of the most critical periods for a crop subjected to salinity (Fowler, 1991) {8}. Germination and seedling establishment are the most crucial stages for determining the grain yield. Several researchers have observed a decrease in germination rate as salinity increases and the osmotic potential of the germination medium decreases [Greenway, 1973{10}; Redmann, 1974{19} and Sharma, 1976 (20)]. Plant growth and metabolism can be altered by saline stress (Misra and Dwivedi, 2004) {16}. Fenugreek (*Trigonella foenum-graecum* L.) is a self pollinated, small seed spices. It belongs to family Fabaceae. It is regarded as moderately tolerant to salinity and used as a condiment and flavoring agent and for medicinal purpose to cure some diseases related to stomach. It is generally known as Methi. This crop is native to an area extending from Iran to Northern India and widely cultivated in China, India, Egypt, Ethiopia, Morocco, Ukraine, Greece, Turkey *etc*. In india, the major fenugreek growing states Rajasthan, Gujrat, Madhya Pradesh, Uttrakhand, Uttar Pradesh, Maharastra, Haryana and Punjab. It is the third largest seed spice in India after coriander and cumin. India occupies a prime position among the fenugreek growing countries in the world. More than 70 percent area and production of the country is contributed by Rajasthan state alone. In India, the seeds are used in curries as spice for adding nutritive value and flavour, dyes and medicines. Fenugreek leaves and seeds are consumed for different purposes such as, medicinal uses (anti-diabetic, lowering blood sugar and cholesterol level, anti-cancer, anti-microbial *etc.*), making food (stew with rice, flavour cheese, syrup and bitter run, mixed seed powder with flour for making flat bread, curries, dyes, young seedlings eaten as a vegetable *etc.*), roasted grain as coffee-substitute, controlling insects in grain storages, food and forage for cattle and in perfume industries. It is moderately tolerant to salinity which makes it suitable for cultivation in major parts of the state. Salinity is one of the most abiotic factors in arid and semi-arid regions in the world which adversely affected the crop yield due to limits the growth and production of crop.

Therefore, germination and seedling establishment are a most critical stage that determined the crop production at later stages. Variability is a pre-requisite to any crop breeding programme. Mean value is the simple measure to assess the variability in germplasm. The objectives of the present study were to assess the mean value response of genotype for their germination and early seedling parameters under salt stress and to identify the viable genotype for saline conditions and identify which level permit and restrict the germination and growth of plants by comparison in control and salinity conditions.

2. Material and Methods:

This study was conducted at the *in-vitro* Laboratory Department of Plant Breeding and Genetics, Sri Karan Narendra College of Agriculture, Jobner (Rajasthan) in *Rabi* season 2016-17. The experiment including 10 genotypes obtained from germplasm collection of All India Coordinated Research Project on Seed Spices, S.K.N. College of Agriculture, Jobner, Jaipur and 5 NaCl concentrations was laid out in randomized block design (RBD) with three replications. Five treatments were used in experiment *viz*., S_0, S_1, S_2, S_3 and S_4 (0, 40, 80, 120 & 160 mM NaCl) induced by supplementing 0.0, 584.4, 1168.8, 1753.2 and 2337.6 mg NaCl in 250 ml double distilled water, respectively. The present experiment was conducted to assess the response of fenugreek on seed germination and subsequent seedling growth of ten genotypes of fenugreek viz., RMt - 305, RMt -351, RMt – 361, RMt – 354, RMt – 365, UM-383, RMt – 1, RMt – 143, RMt – 303 and UM-385 under salinity. Fifteen seeds of each genotype were sown in sterilized petridishes layered with autoclaved germination papers. Seeds were sorted with hand to eliminate broken and small seeds. Uniformly selected seeds were sterilized with 0.1% mercuric chloride for 1 minute and then washed repeatedly for two to three times under running tap water followed by washing with distilled water. Each petri dish was irrigated with 3 ml of test solutions after draining out the previous day's solutions. The temperature was 23 ± 2^0C in the culture room and the set was maintained in dark for the first two days followed by exposure to light achieved by tube lights and incandescent bulbs. A seed was considered to be germinated at the emergence of both radicle and plumule up to 2 mm length (Chartzoulakis and Klapaki, 2000) {5}. The germination was completed within 7 days of planting and germination was monitored 8^{th} day from the day of seed planting. Observations were recorded on 8^{th} day of planting on different morphological early seedling characters and parameters. Five seedlings were randomly selected from each petridish to record the data on plumule length, radicle length, seedling length, plumule to radicle length ratio, plumule fresh weight, radicle fresh weight, plumule dry weight, radicle dry weight and

seedling vigour index. The data on plumule and radicle dry weight was recorded after drying in hot air oven at 65^0C for 48 hours.

The germination percentage was determined by using the following formula (Aniat *et al.*, 2012) {2}:

$$\text{Germination Percentage} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

The plumule to radicle length ratio of seedling was calculated by the following formula (Kagan *et al.*, 2010) {13}.

$$\text{Plumule to Radicle Length Ratio} = \frac{\text{Plumule length}}{\text{Radicle length}}$$

The seedling vigour index was determined by multiplying the sum total of mean length of plumule and radicle of a seedling with germination percentage of the respective seedling by the following formula (Iqbal and Rahmati, 1992) {11}:

Seedling Vigour Index (SVI) = (RL+PL) x (GP)

Where,

RL= Mean radicle length

PL= Mean plumule length

GP= Germination percentage

Simple measures of variability

The genotype mean was calculated by formula:

$$\overline{X} = \frac{\Sigma x}{n}$$

Where,

$\sum x$ = Sum of all observations in a sample

n = Number of observations in a sample

3. Results and Discussion:

Effect of salinity on mean performance

The mean values at different salinity levels for various characters are presented in Table 1 to 10. Perusal of these tables revealed that the mean values of all the characters varied along the salinity gradient. The value was maximum in the control (S_0 salinity level) and minimum at the highest salinity level (S_4) for most of characters.

Germination percentage:

Perusal of tables indicated that the genotypes exhibited significant differences for germination percentage at higher salinity levels 80, 120 and 160 mM NaCl salinity except lower salinity level 0, 40 mM NaCl. This showed inherent differences among the fenugreek genotypes. Significant difference showed presence of adequate genetic variability in the material used for this experiment. In case of germination, the magnitude of germination percentage decreased with increase in salt concentration. It was highest in S_0 (96.89 %) then decreased progressively in S_1 (93.33 %), S_2 (89.11 %), S_3 (88.44 %) and S_4 (82.67 %). Such results have been also reported by Asaadi, 2009 {3} and Ratnakar and Rai, 2013 {18} in fenugreek and by Ashagre *et al*., 2013 {4} in chickpea.

Plumule length, radicle length and seedling length:

Perusal of tables indicated that the genotypes exhibited significant differences for plumule length at all the salinity level. The plumule length was also decreased with increasing level of salinity. It was highest in S_0 (7.16 cm) then decreased progressively in S_1 (6.98 cm), S_2 (5.78 cm), S_3 (4.24 cm) and S_4 (2.71 cm).

The radicle length was decreased with increasing salinity level but it was less affected as compared to plumule length and was highest in S_0 salinity level (4.50 cm) then decreased progressively in S_1 (4.21 cm), S_2 (4.05 cm), S_3 (3.99 cm) and S_4 (2.72 cm).

The seedling length was also decreased with increasing salinity level. It was highest in S_0 (11.65 cm) and then decreased in S_1 (11.19 cm), S_2 (9.83 cm), S_3 (8.23 cm) and in S_4 (5.43 cm).

Such observation was noted earlier in fenugreek [Kapoor and Pande, 2015{14} and Ratnakar and Rai, 2013 {18}, in spinach Keshavarzi *et al*., 2011 {15} and in oat (Chauhan *et al*., 2016 {6}].

Plumule to radicle length ratio, plumule fresh weight and radicle fresh weight:

The plumule to radicle length ratio is a derived character, which showed differential response in different salinity levels. The ratio increased in S_1 (1.69) and decreased in S_0 (1.61) followed by in S_2 (1.45), S_3 (1.07) and S_4 (1.01).

The plumule fresh weight was also highest in S_1 (110.68 mg) then decreased in S_0 (107.78 mg) followed by in S_2 (95.12 mg), S_3 (70.58 mg) and S_4 (54.45 mg).

In case of radicle fresh weight, there was also a decreasing trend with increasing salinity level. It was highest in S_0 and S_1 (31.44 mg) and then decreased in S_2 (31.16 mg), S_3 (28.63 mg) and S_4 (16.36 mg).

The salinity gradient adversely affected the mean values of all the characters with increase in the salinity gradient except in S_1 for plumule to radicle length ratio and plumule fresh weight. There is no difference for radicle fresh weight in S_1 and S_2. Like radicle length that was less affected by salinity because plumule length was found to be more sensitive than radicle length. Radicle fresh weight reduced highly at high salinity levels, it has been observed earlier by Ramoliya *et al*., (2004) {17} and by Asaadi (2009) {3}, Ghorbanpour *et al.* 2011{9} and Ashagre *et al*., 2013 {4}.

Plumule dry weight:

The plumule dry weight was also observed high in S_0 and S_1 (7.84 mg and 7.86 mg) and then decreased with increase in salinity levels i.e. in S_2 (7.76 mg), S_3 (7.03 mg) and S_4 (6.98 mg).

Interestingly reduction in the mean values of plumule dry weight was not much significantly different in 40 mM as compared to the control (0.0 mM). Such stimulatory effect of low salinity has been reported earlier by Jain and Agarwal (1991) {12}, Kapoor and Pande, 2015 {14} and Ghorbanpour *et al.* 2011 {9}.

Radicle dry weight and seedling vigour index:

The radicle dry weight also exhibited a decreasing trend with increase in salinity level. It was maximum in S_0 (1.20 mg) and then decreased in S_1 and S_2 (1.15 mg and 1.16 mg), S_3 (1.09 mg) and S_4 (0.88 mg). The seedling vigour index decreased with increased salinity level. It was maximum in S_0 (1129.49) followed by S_1 (1044.68), S_2 (875.46), S_3 (726.85) and S_4 (447.75).

Such observation was reported earlier in fenugreek Kapoor and Pande, 2015 {14} and Ratnakar and Rai, 2013 {18}, in spinach Keshavarzi *et al*., 2011{15} and in oat Chauhan *et al*., 2016 {6}.

4. Conclusion:

Present study gave information about the effect of salt stress on seed germination and early seedling characters of fenugreek under various salinity levels. Results showed that reduction was highest at 120 and 160 mM NaCl in comparison to 0.0 mM, 40 mM and 80 mM NaCl.

The genotypes exhibited significant differences in all the salinity levels for all the traits except germination percentage in salinity level 0.0 mM and 40 mM indicating inherent differences among the genotypes. A wide range of variability was found for all the traits studied. The mean values of all the traits varied along the salinity gradient. The reduction was highest at 120 and 160 mM NaCl in comparison to 0.0 mM, 40 mM and 80 mM NaCl.

The reduction in mean values was more in plumule length, plumule fresh weight, seedling length and seedling vigour index, while the reduction was lower in germination percentage at lower salinity levels upto 40 mM. On the basis of the rank of a genotype over different salinity levels S_1, S_2, S_3 and S_4 (S_m) and traits, the genotype RMt-303 was found to be most viable option in saline conditions followed by UM-385, RMt-143 and RMt-305. The contrast between mean of different genotypes in control (S_0) versus S_m (mean of S_1, S_2, S_3 and S_4) for each trait also revealed that overall mean was highest in control as compared to the overall mean of salinity levels for all the traits. Such potential lines could serve for effective exploitation for further hybridization programme as a source for salt-responsive candidate genes suitable for crop improvement in saline land as viable option to ensure food security under this climate change era.

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Table: 1. The mean value of genotypes over different salinity levels for germination percentage and plumule length (cm)

Genotypes	Salinity levels									
	Germination percentage					Plumule length (cm)				
	S_0	S_1	S_2	S_3	S_4	S_0	S_1	S_2	S_3	S_4
RMt-305	95.55	95.55	95.55	95.55	88.89	7.33	7.30	5.67	3.40	2.05
RMt-351	95.55	91.11	82.22	80.00	84.45	6.95	6.51	5.75	4.01	2.83
RMt-361	97.78	95.55	93.33	91.11	84.45	5.71	6.53	5.07	3.42	2.61
RMt-354	91.11	91.11	84.45	82.22	80.00	7.31	7.27	5.68	4.92	2.68
RMt-365	95.55	91.11	88.89	88.89	75.55	7.41	6.87	5.79	4.19	2.93
UM-383	95.56	95.55	84.45	84.44	77.78	7.79	6.89	5.39	4.36	3.20
RMt-1	100.00	88.89	88.89	86.67	82.22	6.91	6.75	6.03	3.98	2.75
RMT-143	97.78	93.33	86.67	91.11	86.67	6.93	6.83	6.08	5.19	2.75
RMt-303	100.00	97.78	95.55	95.55	91.11	7.49	6.95	5.74	5.17	2.85
UM-385	100.00	93.33	91.11	88.89	75.55	7.73	7.87	6.61	3.71	2.46
Overall mean	96.89	93.33	89.11	88.44	82.67	7.16	6.98	5.78	4.24	2.71

Table: 2. The mean value of genotypes over different salinity levels for radicle length (cm) and seedling length (cm)

Genotypes	Salinity levels									
	Radicle length (cm)					Seedling length (cm)				
	S_0	S_1	S_2	S_3	S_4	S_0	S_1	S_2	S_3	S_4
RMt-305	3.67	3.97	3.85	3.45	2.30	11.00	11.27	9.52	6.85	4.35
RMt-351	3.85	3.74	3.88	4.29	2.94	10.79	10.25	9.63	8.31	5.77
RMt-361	3.69	3.53	4.06	3.69	2.66	9.40	10.06	9.13	7.11	5.27
RMt-354	4.67	4.71	4.45	3.87	3.07	11.98	11.99	10.13	8.79	5.75
RMt-365	4.60	3.47	3.81	3.17	3.00	12.01	10.34	9.61	7.36	5.93
UM-383	5.29	4.36	3.11	4.16	2.43	13.08	11.25	8.49	8.52	5.63
RMt-1	4.69	4.51	3.67	3.89	2.88	11.60	11.25	9.69	7.87	5.63
RMT-143	4.47	5.38	4.79	4.49	2.29	11.40	12.21	10.87	9.67	5.03
RMt-303	4.65	4.53	4.51	4.51	3.16	12.15	11.48	10.25	9.67	6.01
UM-385	5.39	3.94	4.32	4.39	2.43	13.12	11.81	10.93	8.10	4.89
Overall mean	4.50	4.21	4.05	3.99	2.72	11.65	11.19	9.83	8.23	5.43

Table: 3. The mean value of genotypes over different salinity levels for plumule to radicle length ratio and plumule fresh weight (mg)

Genotypes	Salinity levels									
	plumule to radicle length ratio					Plumule fresh weight (cm)				
	S_0	S_1	S_2	S_3	S_4	S_0	S_1	S_2	S_3	S_4
RMt-305	2.00	1.84	1.48	0.99	0.89	122.04	121.31	100.67	70.88	45.40
RMt-351	1.81	1.75	1.48	0.94	0.96	103.77	121.36	99.99	69.59	50.69
RMt-361	1.55	1.87	1.25	0.93	0.99	98.41	108.67	90.59	71.43	53.67
RMt-354	1.57	1.55	1.28	1.28	0.88	105.14	101.41	90.39	68.18	51.94
RMt-365	1.61	2.00	1.52	1.32	0.98	105.95	108.87	70.93	70.59	60.95
UM-383	1.48	1.58	1.73	1.05	1.32	95.53	106.31	86.83	78.00	59.57
RMt-1	1.48	1.50	1.65	1.02	0.96	103.69	78.91	82.20	60.22	46.39
RMT-143	1.55	1.27	1.27	1.16	1.21	95.55	110.24	97.21	81.13	46.33
RMt-303	1.61	1.54	1.29	1.15	0.90	138.83	138.76	119.41	67.16	68.56
UM-385	1.44	2.00	1.54	0.85	1.02	108.90	110.92	112.93	68.65	60.95
Overall mean	1.61	1.69	1.45	1.07	1.01	107.78	110.68	95.12	70.58	54.45

Table: 4. The mean value of genotypes over different salinity levels for radicle fresh weight (mg) and plumule dry weight (mg)

Genotypes	Salinity levels									
	Radicle fresh weight (mg)					Plumule dry weight (mg)				
	S_0	S_1	S_2	S_3	S_4	S_0	S_1	S_2	S_3	S_4
RMt-305	39.56	31.81	29.91	28.23	14.47	9.14	7.81	9.53	8.40	7.20
RMt-351	29.00	23.17	25.72	24.71	17.39	6.69	8.45	6.85	5.48	6.69
RMt-361	27.81	33.41	33.76	30.59	17.27	7.66	7.82	8.40	7.75	6.85
RMt-354	30.50	29.80	29.58	27.07	17.86	7.30	6.80	6.67	6.93	6.87
RMt-365	30.99	33.35	22.60	27.29	13.94	5.92	6.60	7.11	6.77	5.34
UM-383	35.76	37.15	38.86	28.31	17.31	7.89	8.26	6.63	5.67	5.63
RMt-1	32.94	27.19	33.45	24.15	15.81	8.76	5.87	6.10	5.67	7.20
RMT-143	30.46	24.67	30.54	29.41	14.63	6.87	6.75	7.28	7.59	7.11
RMt-303	20.91	42.14	39.38	34.69	17.48	10.25	10.33	10.45	7.42	9.33
UM-385	36.51	31.72	27.78	31.89	17.41	7.97	9.88	8.55	8.58	7.54
Overall mean	31.44	31.44	31.16	28.63	16.36	7.85	7.86	7.76	7.03	6.98

Table: 5. The mean value of genotypes over different salinity levels for radicle dry weight (mg) and seedling vigour index

Genotypes	Salinity levels									
	Radicle dry weight (mg)					Seedling vigour index				
	S_0	S_1	S_2	S_3	S_4	S_0	S_1	S_2	S_3	S_4
RMt-305	1.23	1.17	1.25	1.15	0.98	1051.75	1076.55	910.25	654.87	385.14
RMt-351	1.01	1.13	1.05	1.13	0.83	1032.42	933.10	790.85	664.09	486.55
RMt-361	1.69	1.35	1.27	1.22	0.81	917.94	962.51	851.33	647.90	445.26
RMt-354	0.90	1.16	1.03	1.19	0.86	1092.25	1092.61	852.78	723.30	457.73
RMt-365	0.97	1.03	1.05	0.84	0.74	1145.75	943.45	854.45	653.34	448.25
UM-383	1.29	1.15	1.21	1.18	0.91	1253.61	1074.55	716.24	717.24	437.73
RMt-1	1.27	0.91	0.99	1.00	0.75	1160.00	1000.19	861.30	682.80	462.58
RMT-143	1.22	1.04	1.25	0.85	0.83	1114.52	1141.20	941.15	880.44	436.18
RMt-303	1.27	1.21	1.17	1.15	0.90	1214.67	1122.61	979.67	925.22	548.31
UM-385	1.19	1.33	1.36	1.21	1.17	1312.00	1100.04	996.61	719.25	369.72
Overall mean	1.20	1.15	1.16	1.09	0.88	1129.49	1044.68	875.46	726.85	447.75

Table: 6. The rank total of different genotypes based on mean (S_m) of salinity levels S_1, S_2, S_3 and S_4

Genotype	Germination (%)	Plumule length (cm	Radicle length (cm)	Seedling length (cm)	Plumule/ Radicle length ratio	Plumule fresh weight (mg)	Radicle fresh weight (mg)	Plumule dry weight (mg)	Radicle dry weight (mg)	Seedling vigour index	Total	Rank
RMt-305	2	9	9	9	4	4	5	3	3	5	53	4
RMt-351	9	8	6	6	5	3	10	6	7	10	70	8
RMt-361	3	10	8	10	7	7	3	4	2	8	62	7
RMt-354	9	4	3	3	8	8	6	7	6	4	58	6
RMt-365	7	6	10	8	1	9	9	9	9	9	77	10
UM-383	8	5	7	7	2	6	2	8	4	7	56	5
RMt-1	6	7	5	5	5	10	7	10	10	6	71	9
RMt-143	4	1	1	1	9	5	8	5	8	2	44	3
RMt-303	1	2	2	2	10	1	1	1	4	1	25	1
UM-385	5	3	4	4	3	2	4	2	1	3	31	2

Note: S_0, S_1, S_2, S3 and S_4 represent 0, 40, 80, 120 and 160 mM NaCl , respectively.

Table: 7. The comparison between overall mean of different genotypes in control (S_0) versus S_m (mean of S_1, S_2, S_3, & S_4)

Genotype		Germination (%)	Plumule length (cm	Radicle length (cm)	Seedling length (cm)	Plumule/ Radicle length ratio	Plumule fresh weight (mg)	Radicle fresh weight (mg)	Plumule dry weight (mg)	Radicle dry weight (mg)	Seedling vigour index
RMt-305	S_0	95.55	7.33	3.67	11.00	2.00	122.04	39.56	9.14	1.23	1051.75
	S_m	93.89	4.61	3.39	8.00	1.30	84.57	26.11	8.24	1.14	756.70
RMt-351	S_0	95.55	6.95	3.85	10.79	1.81	103.77	29.00	6.69	1.01	1032.42
	S_m	84.45	4.78	3.71	8.49	1.28	85.41	22.75	6.87	1.04	718.65
RMt-361	S_0	97.78	5.71	3.69	9.40	1.55	98.41	27.81	7.66	1.69	917.94
	S_m	91.11	4.41	3.49	7.89	1.26	81.09	28.76	7.71	1.16	726.75
RMt-354	S_0	91.11	7.31	4.67	11.98	1.57	105.14	30.50	7.30	0.90	1092.25
	S_m	84.45	5.14	4.03	9.17	1.25	77.98	26.08	6.82	1.06	781.61
RMt-365	S_0	95.55	7.41	4.60	12.01	1.61	105.95	30.99	5.92	0.97	1145.75
	S_m	86.11	4.95	3.36	8.31	1.46	77.84	24.30	6.46	0.92	724.87
UM-383	S_0	95.56	7.79	5.29	13.08	1.48	95.53	35.76	7.89	1.29	1253.61
	S_m	85.56	4.96	3.52	8.47	1.42	82.68	30.41	6.55	1.11	736.44
RMt-1	S_0	100.00	6.91	4.69	11.60	1.48	103.69	32.94	8.76	1.27	1160.00
	S_m	86.67	4.88	3.74	8.61	1.28	66.93	25.15	6.21	0.91	751.72
RMT-143	S_0	97.78	6.93	4.47	11.40	1.55	95.55	30.46	6.87	1.22	1114.52
	S_m	89.45	5.21	4.24	9.45	1.23	83.73	24.81	7.18	0.99	849.74
RMt-303	S_0	100.00	7.49	4.65	12.15	1.61	138.83	20.91	10.25	1.27	1214.67
	S_m	95.00	5.18	4.18	9.35	1.22	98.47	33.42	9.38	1.11	893.95
UM- 385	S_0	100.00	7.73	5.39	13.12	1.44	108.90	36.51	7.97	1.19	1312.00
	S_m	87.22	5.16	3.77	8.93	1.35	88.36	27.20	8.64	1.27	796.41
Mean	S_0	96.89	7.16	4.50	11.65	1.61	107.78	31.44	7.85	1.20	1129.49
	S_m	88.39	4.93	3.74	8.67	1.31	82.71	26.90	7.41	1.07	773.68