



Research Paper

EVALUATION OF FOXTAIL MILLET *Setaria italica* GENOTYPES FOR GRAIN YIELD AND BIOPHYSICAL TRAITS

S.M. Brunda¹, M.Y. Kamatar², K.L. Naveenkumar², Ramling Hundekar¹ and H.H. Sowmya²

¹Department of Plant Breeding and Genetics,
Kerala Agricultural University, Tiruvananthapuram, India

²Department of Genetics and Plant Breeding,
University of Agricultural Sciences, Dharwad, India.

Abstract

Seventy five foxtail millet genotypes were evaluated for yield and its attributing traits during rainy and summer seasons of 2014. All the genotypes displayed considerable amount of differences in their mean performance with respect to all the characters. The analysis of variance revealed the presence of highly significant differences in germplasm collections for all the characters under study for indicating presence of genetic variability for most of the traits. The grain yield per plot in summer season was higher than the rainy season. In rainy season among the 75 genotypes 20 of them have recorded the higher grain yield per plant than best check Sia 326 of which DHF 1 has recorded highest grain yield of 48 g followed by DHF 16 (43 g) Ise 900 (43 g). In summer season genotypes DHF 26 (148g) followed by DHF 27 (143 g) and DHF 13 (142 g) recorded the highest grain yield per plant when compared to the high yielding check HMT 100-1.

Key words: Foxtail millet, genotypes, rainy, summer, yield.

INTRODUCTION

Millets are important crops in the semi arid tropics of Asia and Africa with 97 percent of millet production in developing countries. They have been in cultivation in East Asia for the last 10,000 years. These are preferred crop of this region due to their short growing season under dry, high-temperature conditions. Millets have been important food staples in human history, particularly in Asia and Africa. Grown under traditional methods, no millet attracts any pest. A majority of them are not affected by storage pests either. Therefore, their need for pesticides is close to nil. Farmers of Karnataka grow millets organically with no pesticides and fertilizers and tolerant to disease, can be cultivated with less water or under drought conditions, with less labour requirement [1]. Thus they can be termed as crops of organic farming food. Thus, they are a great boon to the agricultural environment. Millets are amazing in their nutrition content. Among the eight millets foxtail millet is fairly tolerant of drought. Due to its quick growth, it can be grown as a short-term catch crop. Its grain is used for human consumption and as feed for poultry and cage birds. Foxtail millet ranks second in the total world production of millets and continues to have an important place in the world agriculture providing approximately six million tons of food to millions of people, mainly on poor or marginal soils in southern Europe and in temperate, subtropical and tropical Asia. It is an important staple food in India and northern China. The grain can be cooked in the same manner as rice and has many food

applications (porridge, pudding, breads, cakes, flour, chips, rolls, noodles etc.). Further healthy and therapeutic food products can be prepared and used to maintain good health [2] [3] [4] [5]. (Kamatar 2013; Kamatar et al. 2014a; Kamatar et al. 2014b; and Kotagi et al., 2013). A high intake of foxtail millet based dietary fiber, improves glycemic control, decreases hyperinsulinemia, and lowers plasma lipid concentrations in patients with type 2 diabetes in human beings [6]. In spite of this area under millets is decreasing ultimately the production and availability. Hence there is need to increase the production by developing the high yielding genotypes. The improvement in millet yield potential and spread of millet cultivation can play an important role in the economy of many under developed countries of the world [7]. Improvements of these traits depend on the existence of variability. The variability for the characters of economic importance is the basic prerequisite to bring improvement in a crop. Considerable variability is available in foxtail millet for yield and yield contributing traits [7] [8] [9] and for nutrition parameters [10] [11]. Attempts are made in the present to explore the variability in elite and diverse germplasm lines of foxtail millet for yield and yield attributing traits.

MATERIAL AND METHODS

This experiment material comprised of 44 genotypes of foxtail millet elite s obtained from All India Coordinated Millet Improvement Project, Bangalore and 31 developed lines at Agricultural Research Station Hanumanatti. These genotypes were from different geographical origin viz., Andhra Pradesh, Tamil Nadu, Orissa, Bihar, Kerala, Uttar Pradesh, Rajasthan, Karnataka, China and USA, hence had lot of diversity among themselves. The experiment was laid out in medium deep black soil at Agricultural Research Station Nipani during rainy and summer seasons of 2013 and 2014 respectively. The collected elite 75 genotypes along with 3 national checks HMT 100 -1, PS 4 and Sia 326 were sown in randomized block design with three replications. Each entry was sown in two rows of 3 m length with inter row spacing of 30 cm and intra row spacing of 10 cm. Fertilizer dose of 40:20:20kg/ha of NPK was applied and all the recommended practices were followed to raise a good crop of foxtail millet and to express their potentiality. From each entry in each replication five randomly selected plants were tagged for recording observations on the quantitative characters. Mean of five plants for each character was worked out and used for statistical analysis. Measurements were recorded at appropriate stages of plant growth on all the eleven quantitative characters viz., days to flowering, days to maturity, number of productive tillers per plant, panicle length (cm), panicle breadth (cm), panicle weight per plant (g), grain yield per plant (g), grain yield per plot (g), test weight (g), straw weight per plant (g). The mean of five plants in each replication was used for analysis of variance. The differences among the genotypes were tested by 'F' test as given in the table below. Transformed data were used for analysis of variance. For each character and for all genotypes, analysis of variance was carried out separately. The significance of the differences among all the genotypes was tested by 'F' test using the error variance.

RESULTS

The mean sum of squares for grain yield and its yield component traits in 75 genotypes along with three checks of foxtail millet are presented in Table 1 and 2, rainy season and summer, respectively. The mean performance of all the foxtail millet genotypes in respect of grain yield and its component traits during both rainy and summer seasons are given in Table 3.

Days to flowering

Days taken by 50 per cent of the plants to initiate flowering in 78 genotypes varied from 31 to 94 days with a mean value of 45 during rainy season whereas it varied from 33 to 58 days with a mean value of 47 days in summer. 60 genotypes were earliest to flower among them genotypes viz., Ise 1685, RFM 10 and Ise 1312 took 31,32 and 33 days to flower during rainy season and in summer same genotypes took 33, 34 and 35 days for flowering. The germplasms DHF 29, ST 13 took 94 days and GS 2109, Narasimharaya took 58 days for late flowering during rainy season and summer season respectively.

Days to maturity

Range of variation for days to maturity was from 61 to 104 days and in checks with a mean value of 45 days during rainy season and it ranged from 60 to 103 days with a mean value of 89 days in summer season. In rainy season Ise 900 genotype was early to mature by taking minimum number of 61 days in rainy season and 60 days in summer. This was followed by Ise 1685 (68 and 67 days) and Ise 1312 (69 and 68 days) in rainy season and summer respectively. On the other side DHF 24 was very late to mature by taking as much as 104 and 103 days followed by DHF 28 which took 103 and 102 days for maturity in rainy season and summer respectively.

Plant height (cm)

Plant height exhibited a wide variation of 68 to 138 cm with a mean value of 123 cm during rainy season and it ranged between 120 and 177 cm with a mean value of 157 cm in summer. In rainy season, the genotype, RFM 10 (68 cm) was the dwarfest among 78 genotypes followed by CO 4 (103 cm) and Srilakshmi (104 cm). The tallest plant was K 2 which recorded the height of 138 cm which was followed by GS 2105 and K 222 1(137 cm). whereas in summer, GS 121 (120 cm) was dwarf among 78 genotypes followed by GS 740 (134 cm) and Ise 1647 (136 cm), the genotype DHF 20 recorded tallest height of 177 cm followed by check HMT 100-1 (176 cm) and then DHF 12 (174 cm).

Number of productive tillers per plant:

Number of productive tillers per plant ranged between 5 to 15 during rainy season and 16 to 41 in summer. The mean number of tillers produced were more during summer with a mean value of 25 as against only 10 tillers during rainy season. In rainy season for productive tillers, 36 genotypes significantly exceeded the best check PS 4, among all the evaluated genotypes DHF 8, GS 592 and GS 2197 had 15 productive tillers per plant whereas Krishnadevaraya and Ise 140 had as low as 5 tillers, followed by DHF 23 (6 tillers). In summer season the genotype Pratapkagni and K 222-1(41 tillers) had produced highest number of tillers per plant followed by GS 2109 (36 tillers) whereas DHF 25 and GS1483 produced 16 tillers per plant.

Panicle length (cm)

Panicle length ranged between from 7 to 28 cm in rainy season and 14 to 33 cm in summer with a mean value of 20 cm in both the seasons. Among the 30 genotypes Arjuna (29 cm), GS 2197 (33 cm) followed by DHF 9 and GS 2159 (32 cm) were superior when compared with the best check PS-4 in rainy season and summer respectively. Panicle length was lowest among the genotype RFM 10 (7 cm) followed by GS 515 (11 cm) in rainy season whereas in summer, H-1 genotype recorded lowest panicle length (14 cm) followed by H 2 and Co 4 (15 cm).

Panicle breadth (cm)

Considerable variation between the genotypes did exist in respect of this trait as seen by mean values ranging between 4 and 9 cm in rainy season and 5 to 8 cm in summer with mean values of 6 in both the seasons. In rainy season panicle breadth was highest in the genotype GS 2215 (9.15 cm) followed by Ise 375(8.23 cm) and DHF 23(7.67 cm) whereas the genotypes RFM 10, (4.56 cm), Ise 931(5.13 cm) and DHF 30 (5.57 cm) recorded lowest panicle breadth. In summer Ise 375(7.69 cm), DHF 21 (7.05 cm) and GS 511(7.00 cm) had recorded the highest panicle breadth whereas the genotypes GS 2105(4.58 cm), GS 2109 (5.05 cm) and H 1(5.05 cm) recorded minimum panicle breadth.

Panicle weight per plant (g)

Significant variation was observed for panicle weight between seasons as evidenced by large differences in their mean values (44g and 132g) in rainy season and summer season respectively. Range of variation for panicle weight was from 11g to 75g in rainy season and 36g to 184g in summer. In rainy season 34 genotypes recorded highest panicle weight among them GS 2108 (75g), DHF 9 (65 g) and GS 740 (63g) were significantly superior when compared with

the best check HMT 100-1. Lowest panicle weight was recorded in RFM 10 (23g) followed by CO 4 (30g) and GS 2040 (31g). In summer season DHF 28 (183 g) followed by DHF 27 (177 g) and DHF 29 (177g) had recorded highest panicle weight when compared with the best check HMT 100-1. Ise 1647 (35 g) and GS 1000 (79 g) and H 2 (89 g) has recorded minimum panicle weight per plant.

Grain yield per plant (g)

Grain yield is an important economic trait; hence the variability in this trait is important. Grain yield per plant exhibited highest mean of 44 and 104 with a range value of 38g to 250 g and 24g to 148 g in rainy season and summer respectively. In rainy season among the 75 genotypes 20 of them have recorded the higher grain yield per plant than best check Sia 326 of which DHF 1 has recorded highest grain yield of 48 g followed by DHF 16 (43 g) Ise 900 (43 g). In summer season genotypes DHF 26 (148g) followed by DHF 27 (143 g) and DHF 13 (142 g) recorded the highest grain yield per plant when compared to the high yielding check HMT 100-1.

Grain yield per plot (g)

Larger difference was noticed for grain yield per plot with mean values of 571 g and 240 g in rainy season and summer respectively. In rainy season range of variation for this trait was 184 g to 659 g in summer it is between 437 g to 1354 g. In rainy season fifteen genotypes recorded significant higher grain yield per plot among them DHF 2 (560 g) followed by DHF 13 (387 g) and DHF 5 (386 g) when compared with check PS-4. In case of summer 22 genotypes exhibited significantly higher grain yield per plot among them, DHF 10 (1354 g), DHF 17 (1305 g) and DHF 16 (1305g) were the top genotypes when compared to the superior check PS 4.

Test weight (g)

Seed weight of all the 78 foxtail millet germplasm ranged between 2.08 and 3.87 gram in both the seasons. Further, the mean seed weight did not vary much for rainy season (3.16 g) and summer (3.08 g) season which was almost equal to 3.00 gram. Genotype RFM 10, Sia- 3085 and Meera have recorded lowest test weight of 2.08 g in both the seasons. On the other hand GS 2159, Srilakshmi and DHF 2 have recorded maximum test weight of 3.87 g in both the season when compared with the check HMT 100-1.

Straw weight per plant (g)

Straw yield is the second economically important trait in India as our nation has largest animal population. The mean ranged between from 31 to 276 g and 50 to 300 g in rainy season and summer respectively. In rainy season, DHF 5 had recorded maximum straw weight of (276g) followed by DHF 23 (116 g) and DHF 25 (96 g) whereas the genotypes RFM 10 (31g) followed by Arjuna (36g) and DHF 27 (38g) recorded the lowest straw weight.

In summer, the highest straw weight was recorded by the genotype Chithra (300 g) followed by Meera (288 g) and DHF 13 (285 g) whereas the genotypes Ise 1647 (49.84 g), H 1 (101g) and GS 740 (118 g) recorded lowest straw weight.

DISCUSSION

The analysis of variance among 78 genotypes indicated the significant differences among the genotypes for all the 11 characters studied. All the genotypes displayed considerable amount of differences in their mean performance with respect to all the characters. This had been exemplified by highly significant mean sum of squares which indicates that the germplasm collections under study were genetically diverse for most of the traits. Similar results were obtained by earlier researchers for morphological traits [12] and also for nutritional traits [10] [11] [13]. The analysis of variance revealed the presence of highly significant differences in germplasm collections for all the characters under study for indicating presence of genetic variability for most of the traits.

Flowering is one of the important traits for determining the duration of genotypes. Days taken by 50 per cent of the plants to initiate flowering in 78 genotypes varied from 31 to 94 days with

a mean value of 45 during rainy season whereas it varied from 33 to 58 days with a mean value of 47 days in summer. Similarly range of variation for days to maturity was from 61 to 104 days and in checks with a mean value of 45 days during rainy season and it ranged from 60 to 103 days with a mean value of 89 days in summer season. During both the rainy season and summer season 60 genotypes were earliest to flower, of which Ise 1685, RFM 10 and Ise 1312 were the earliest to flower than all others. Similarly these two lines Ise 1685 (68 and 67 days) and Ise 1312 (69 and 68 days) were comparatively early to mature also in rainy season and summer respectively. However in rainy season Ise 900 genotype was very much early to mature by taking minimum number of 61 days in rainy season and 60 days in summer. These three genotypes are useful to farmers of dry land to grow them shorter period to escape drought.

Grain yield is an important economic trait; hence the variability in this trait is important. Grain yield per plant exhibited highest mean of 44 and 104 with a range value of 38g to 250 g and 24g to 148 g in rainy season and summer respectively. In rainy season among the 75 genotypes 20 of them have recorded the higher grain yield per plant than best check Sia 326 of which DHF 1 has recorded highest grain yield of 48 g followed by DHF 16 (43 g) Ise 900 (43 g). In summer season genotypes DHF 26 (148g) followed by DHF 27 (143 g) and DHF 13 (142 g) recorded the highest grain yield per plant when compared to the high yielding check HMT 100-1.

The grain yield per plot in summer season was higher than the rainy season. The higher grain yield of foxtail millet genotypes in summer season may be due to sufficient availability of moisture as the summer crop is raised under irrigation. This is supported by production of higher number of tillers by the genotypes in summer season. Further the increased photosynthetic activity of genotypes due to higher sunshine hours in summer season produced more translocates which resulted in higher sink. Similar trend was noticed for straw yield where in 220 percent higher yield was noticed in summer than rainy season. This is because foxtail millet genotypes grew taller and produced higher number of tillers in summer season.

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Plant height exhibited a wide variation of 68 to 138 cm with a mean value of 123 cm during rainy season and it ranged between 120 and 177 cm with a mean value of 157 cm in summer. The tallest plant was K 2 which recorded the height of 138 cm which was followed by GS 2105 and K 222 1(137 cm).whereas in summer, GS 121 (120 cm) was dwarf among 78 genotypes followed by GS 740 (134 cm) and Ise 1647 (136 cm), the genotype DHF 20 recorded tallest height of 177 cm followed by check HMT 100-1 (176 cm) and then DHF 12 (174 cm). Tallest plants are desired by farmer as the produce higher biomass.

In rainy season for productive tillers, 36 genotypes significantly exceeded the best check PS 4 in their performance of which DHF 8, GS 592 and GS 2197 exhibited highest number of productive tillers. Thirty genotypes recorded the higher panicle length than the best check PS 4, among them Arjuna, DHF 9, GS 2105 and GS 2109 genotypes were significantly for this trait. Thirty four genotypes viz., GS 2109, DHF 9, GS 470, Ise 900, Ise 34, DHF 1 and DHF 2 exhibited significant highest panicle weight compared to the best check HMT 100-1. Among the 75 genotypes 20 genotypes are significantly higher grain yield per plant than best check Sia 326, of which DHF 1, DHF 16, Ise 900, Ise 758, DHF 2, DHF 5, DHF 26, Narsimharaya and GS 2164 were highest performing genotypes. Fifteen genotypes recorded significant higher grain yield per plot DHF 2, DHF 13, DHF 5, DHF 18, DHF 1, DHF 4, DHF 20, DHF 19 DHF 16, DHF 25, DHF 26, DHF 7, GS 740, GS 2109 and GS 2105 compared to the best check PS- 4. DHF 2 was the top on this trait than all. Fourteen genotypes exhibited significant higher test weight among them GS 2159, Srilakshmi, DHF 2, DHF 3, GS 2105, GS 2126, GS 1000, GS 2109. DHF 21, DHF 30, DHF 29, GS 2192, DHF 16 and DHF 4 were the genotypes for this trait than best check PS 4.

In summer season genotypes DHF 26, DHF 27, DHF 13 and DHF 23 according to their merits were significantly highest producer of grain yield per plant compared to the high yielding check HMT 100-1. Twenty two genotypes show the significantly highest grain yield per plot among them DHF 10, DHF 17, DHF 16, GS 949 and GS 2215 were the top genotypes when compared to the best check PS-4. Genotypes viz., DHF 28, DHF 26, DHF 29, DHF 13, Ise 931 and GS 2040 were the significant higher panicle weight compared to the best check HMT 100-1. Twenty one genotypes recorded higher panicle length than the best check HMT 100-1, of which GS 2197, GS 2159 and GS 2105 were the significant. For test weight 31 genotypes shows significant highest value among them Srilakshmi, GS 2159 and DHF 2 were the top three compare to the best check HMT 100 -1.

Table 1. Analysis of variance for yield and its components in foxtail millet Genotypes during rainy season 2013

Sources of variation	DF	Days to flowering	Days to maturity	Plant height (cm)	Productive tillers / plant	Panicle length	Panicle breadth	Panicle weight/ plant	Grain yield/ plant	Grain yield/ Plot	Test weight	Straw weight / plant
Replications	2	1.20	9.01	775.79	45.53	9.85	0.05	192.04	3.64	233.34	1.70	788.97
Genotype	77	97.29*	246.38**	309.20**	17.00**	29.02**	1.13**	366.05**	96.19**	23389.24**	0.52**	2373.34*
Error	154	1.58	36.53	43.97	5.32	9.80	0.29	24.18	19.34	716.73	0.02	1731.59
CV		2.77	6.71	5.39	21.23	15.56	8.33	11.07	12.78	11.14	5.05	61.63
SE		0.73	3.49	3.82	1.33	1.81	0.31	2.84	2.54	15.46	0.092	24.03
CD @5%		2.03	9.75	10.62	3.72	5.05	0.87	7.93	7.09	43.18	0.25	6.71

*Significant at 5 % probability

** Significant at 1 % probability

Table 2: Analysis of variance for yield and its components in foxtail millet Genotypes during summer season 2014

Sources of variation	DF	Days to flowering	Days to maturity	Plant height	Productive tillers / plant	Panicle length	Panicle breadth	Panicle weight/ plant	Grain yield/ plant	Grain yield/ Plot	Test weight	Straw weight / plant
Replications	2	2.32	9.35	2715.31	51.80	1.69	0.99	235.62	1187	65714	1.85	0.43
Genotype	77	101**	241**	331**	88.**	28**	0.92*	2053**	1563**	114299**	0.54**	0.13*
Error	154	1.78	36.49	114.41	7.22	1.90	0.10	379.26	167.90	7494.	0.03	0.01
CV		2.84	6.77	6.80	10.45	6.71	5.21	14.71	12.45	10.23	5.33	5.06
SE		0.77	3.49	6.17	1.55	0.79	0.18	11.24	7.48	49	0.09	0.04
CD @5%		2.15	9.74	17.26	4.33	2.22	0.51	31.41	20.90	139	0.26	0.12

*Significant at 5 % probability

** Significant at 1 % probability

Table 3. Mean performance of 78 genotypes of foxtail millet with respect to biophysical traits

Sl No	Genotype	Days to flowering		Days to maturity		Plant h eight (cm)		Productive tillers / plant		Panicle length		Panicle breadth		Panicle weight		Grain yield/ plant		Grain yield/ Plot		Test weight		Straw weight / plant	
		R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S
1	RFM-10	32	34	89	88	68	145	7	27	8	16	4.56	5.47	23	143	11	98	95	623	2.23	2.22	31	97
2	H 1	54	56	91	90	115	146	11	18	13	14	5.97	5.05	47	103	15	63	116	437	2.82	2.75	73	101
3	H 2	54	56	88	87	120	162	8	19	15	16	6.19	5.67	37	89	16	61	258	619	2.75	2.74	66	164
4	CO 4	37	36	80	79	103	154	9	21	16	16	5.89	5.72	30	140	25	117	91	764	2.77	2.56	63	216
5	K 2	56	58	98	97	138	170	8	32	15	17	6.95	5.67	33	104	30	88	109	789	2.76	2.75	54	192
6	Krishnadeva raya	37	39	81	80	111	153	5	32	21	19	6.02	5.61	47	105	35	78	148	769	2.75	2.74	56	171
7	Narasimhara ya	56	58	92	91	115	166	9	21	19	17	6.53	6.30	46	136	42	104	117	735	2.94	2.93	63	202
8	Chithra	47	46	95	93	119	171	11	32	19	17	6.38	6.37	51	158	33	116	136	652	3.01	2.94	61	300
9	Arjuna	43	42	85	83	113	173	8	22	29	17	6.52	6.53	42	158	31	128	180	888	2.73	2.26	36	279
10	Srilakshmi	44	45	82	81	104	152	9	33	18	18	6.43	5.61	56	138	36	106	144	750	3.88	3.87	60	236
11	K-222-1	46	48	81	80	138	154	9	42	24	19	6.91	5.43	41	139	35	107	245	649	2.98	2.97	95	244
12	Sia -3085	45	46	80	78	119	163	9	22	23	17	6.43	6.44	36	138	36	112	245	666	2.25	2.08	81	189
13	Meera	35	37	72	71	124	160	12	34	17	17	6.13	6.32	44	162	41	132	119	923	2.31	2.30	94	288
14	Pratap kagni	45	47	85	84	133	143	13	37	20	17	6.95	5.34	51	130	28	105	74	867	2.95	2.94	66	166
15	Ise 375	54	56	88	87	118	155	8	19	16	17	8.23	7.69	37	132	23	105	117	503	2.51	2.50	78	262
16	Ise 1312	33	35	69	68	130	155	14	25	20	16	6.35	6.85	43	113	36	111	139	776	2.91	2.90	82	231
17	Ise 1468	35	37	79	78	121	164	13	19	18	18	6.41	6.59	41	106	37	92	132	712	3.01	3.00	66	152
18	Ise 1685	31	33	68	67	132	159	12	26	20	20	7.34	6.39	36	100	23	80	83	1044	2.58	2.57	50	203
19	Ise 900	36	38	62	61	132	154	8	30	23	21	6.59	6.34	61	124	43	67	189	873	3.13	3.12	89	127
20	Ise 140	46	48	79	78	132	161	6	26	23	20	6.65	6.63	41	101	32	81	193	887	3.15	3.14	52	159
21	Ise 758	45	47	92	91	126	162	9	25	19	21	6.76	6.42	49	105	43	78	261	956	2.89	2.88	59	149
22	Ise 1647	44	46	84	83	132	136	15	18	18	19	6.59	6.42	33	35	28	24	136	819	3.09	3.08	57	50
23	Ise 931	47	49	84	83	115	163	14	32	19	23	5.13	6.34	39	168	32	100	145	743	2.66	2.65	67	239
24	GS 2164	52	54	89	88	129	156	11	34	22	20	7.09	6.03	52	143	38	107	229	1015	2.81	2.74	60	210
25	GS 2040	36	38	86	85	134	158	14	30	23	19	6.84	6.27	32	167	30	114	220	757	2.90	2.83	44	203
26	GS 515	46	48	94	93	125	147	15	30	11	19	6.14	5.55	42	107	31	84	187	477	2.88	2.81	52	132
27	GS 949	53	54	101	88	108	145	10	27	19	16	6.38	5.45	32	143	16	98	230	623	2.85	2.78	62	153
28	GS 592	48	56	86	90	122	146	15	18	23	14	6.77	6.47	54	103	33	63	316	437	3.14	3.07	62	191
29	GS 511	46	56	102	87	128	162	7	19	22	16	6.80	7.00	49	89	34	61	203	619	2.94	2.87	69	201
30	GS 90	46	48	98	97	119	164	12	26	23	22	5.99	5.41	51	128	36	102	245	885	2.66	2.59	63	254
31	GS 121	51	53	83	82	127	120	13	22	23	20	6.54	5.53	38	113	39	64	282	760	3.40	3.33	84	136
32	GS 271	52	54	89	88	129	137	14	34	21	19	6.14	5.16	57	104	37	89	303	942	3.42	3.35	60	135
33	GS 740	53	55	99	98	126	134	13	27	20	17	6.00	5.42	63	113	36	68	342	517	3.50	3.43	60	118
34	GS 1000	52	54	86	85	132	145	12	26	22	18	6.49	5.41	51	78	32	94	151	579	3.72	3.65	58	145
35	GS 1483	39	41	78	77	123	137	8	17	19	20	5.77	6.23	40	115	34	94	185	751	2.82	2.75	59	153
36	GS 1560	50	52	80	79	128	146	11	30	18	20	6.05	5.45	51	135	34	107	196	884	2.48	2.41	82	271
37	GS 2099	47	49	92	91	118	155	14	34	20	21	5.88	5.27	44	128	34	106	302	1120	2.45	2.38	65	266
38	GS 2105	54	56	102	101	138	166	12	19	24	25	6.77	4.58	43	155	37	127	334	551	3.82	3.75	91	260
39	GS 2109	56	58	101	100	126	153	14	36	24	21	6.19	4.85	75	124	34	111	337	660	3.68	3.61	71	200
40	GS 2126	44	46	102	101	121	148	11	25	18	23	5.75	5.26	37	107	27	86	176	644	3.82	3.75	53	188
41	GS 2159	46	48	101	100	114	146	12	33	20	32	6.69	5.39	41	122	26	85	192	666	3.89	3.82	65	177
42	GS 2192	47	49	92	91	115	156	14	25	19	24	6.22	5.33	48	127	25	85	212	737	3.59	3.52	55	199
43	GS 2197	47	49	83	82	114	156	15	34	22	33	5.95	5.85	46	137	30	107	181	1103	3.54	3.47	55	258
44	GS 2215	73	47	93	92	112	156	12	20	14	20	9.15	5.35	41	153	26	130	216	1173	3.26	3.19	78	201
45	DHF 21	66	44	82	81	119	165	13	19	19	16	6.80	7.05	42	155	25	137	186	716	3.67	3.60	46	246
46	DHF 22	63	39	94	93	119	163	9	21	20	21	7.49	6.20	35	139	29	112	221	916	2.96	2.89	50	247
47	DHF 23	54	55	78	77	120	157	6	22	21	23	7.67	6.23	33	159	29	140	210	885	2.89	2.82	116	270
48	DHF 24	56	49	104	103	126	153	13	30	20	22	6.41	6.29	48	152	34	123	279	994	3.29	3.22	63	266
49	DHF 25	63	55	98	97	133	137	9	17	22	19	7.27	6.80	38	132	42	121	360	927	2.69	2.62	96	232
50	DHF 26	61	46	102	100	132	155	11	24	21	24	6.83	5.84	42	177	36	148	346	1113	3.30	3.23	81	278
51	DHF 27	36	46	94	93	127	160	10	22	20	22	6.36	6.32	35	159	26	143	286	1056	3.25	3.		

78	Sia 326	82	52	89	89	117	163	9	19	18	20	6.47	6.12	40	90	37	72	287	785	3.42	2.95	53	138
Mean		45.4	47	90.1	89.2	122	157	10.8	25.7	20.1	20.5	6.53	5.9	44.4	132	34.4	104	240	846	3.15	3.08	6.52	215
C.V.		2.77	2.84	6.70	6.77	5.39	6.81	11.6	10.4	15.5	6.7	8.3	5.2	11.7	14.7	12.7	12.4	11.1	10.23	5.05	5.33	6.63	8.68
S.E.		0.73	0.77	3.49	3.49	3.83	6.18	1.33	1.55	1.81	0.80	0.31	0.18	2.84	11.2	2.53	7.48	15.4	49.98	0.09	0.09	2.03	10.8
C.D @ 5%		2.03	2.15	9.75	9.74	10.7	17.2	3.72	4.33	5.05	2.23	0.88	0.50	7.93	31.4	7.09	20.9	43.1	139	0.25	0.26	6.71	30.1
C.D. @ 1%		2.68	2.84	12.8	12	14.1	22.7	4.91	5.7	6.67	2.94	1.16	0.66	10	41.4	9.36	27.5	57.0	184	0.34	0.35	8.62	39.8

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