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Research Article

Study of combining ability effects in forage sorghum hybrids for yield and quality traits

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Abstract
Sorghum is a multipurpose crop being used as food, feed, fodder and fuel. The objective of the study was to investigate breeding values of new F_1 forage sorghum hybrids using line x tester crossing of six A_1 cytoplasm type male sterile lines with five fertile local inbred lines and varieties, and 30 F_1 hybrids were produced. Both parental lines and their F_1 hybrids were field-evaluated for yield and quality traits for two successive years. On the basis of two year hybrids evaluation programme, the lines, 637 A and 753 A were good general combiners for fodder yield and related traits and the lines 467A was found good general combiner for total soluble solids TSS. The testers HJ 541 and IS 2389 were found good general combiners for various yield traits and TSS. On the basis of specific combining ability, the crosses 467A X 2389, 725A X 308, 2219A X G46 and 2219A X HJ 541 were found to be promising for yield related traits. The crosses 467A X 2389, 637AX HJ 541, 637A X HC 308 exhibited good standard heterosis for fodder yield and related traits and the crosses 9A X 2389, 725A X 2389 and 753A X 2389 for TSS. On the basis of above study 467A X 2389 hybrid was found to be promising for fodder yield and related traits.

Keywords
Forage sorghum, Heterosis, GCA and SCA

Introduction

India being agriculture based country. About 65% population depends on livestock for their livelihood and livestock sector contribute about 7% to national GDP. Livestock population of India is 500 million and is increasing by 1.23% annually thus it supports 20 % of the livestock population of the world on 2.3 % geographical area only. Milk production of the country is 94.5 m tonnes which is highest in the world with per capita milk availability is 40 g per day. But still their is huge gap in demand and supply of green as well as fodder for livestock and by 2025 requirement of green fodder will be 1170 m tonnes, dry fodder yield will be 650 m tonnes and of concentrates will be 152 m tonnes Nigam *et al.(*2011).

The importance of sorghum as a forage crop is growing in many regions of the world due to its high productivity and ability to utilize efficiently water even under drought conditions. The leaves and stem have a waxy coating (called bloom) and ability to fold rather than roll during drought, reducing transpiration under hot, dry conditions. As nutritional quality is concerned, it is highly palatable and more digestible than maize and pearl millet. It produces a tonnage of dry matter having digestible nutrients (50%), crude protein (8%), fat (2.5%) and nitrogen free extracts (45%) Azam *et al.(*2010).Due to expanding livestock population there is an urgent need to increase the forage sorghum yield to meet the growing fodder demand. The farmers have a preference for sorghum as it can be utilized for different purposes like fresh fodder, hay and silage and grows well in arid and semiarid tropics Dara Singh and Sukhchain(2010). It has quick growth habit, have regeneration potential after cutting and it provide highly palatable and nutritious fodder for livestock. Forage sorghum hybrids are commonly grown in areas where rainfall is insufficient for corn production and may be utilized as silage, greenchop, pasture, or dry hay or fodder.

Major objective of the fodder sorghum improvement is to enhance its biomass production via exploitation of heterosis. Dangi and Paroda, 1978 reported high amount of heterosis for fodder yield and its related traits and thus advocated the possibility of economic exploitation of heterosis through the use of male sterile lines. Hence the present investigation was carried out to estimate the general and specific combining ability effects of the parents and crosses in forage sorghum and identification of potential crosses and exploit them to meet the growing fodder demand.

Materials and Methods

In the present study, F_1 hybrids were obtained from crossing six cytoplasmic male sterile lines (9A, 467A, 637A, 725 A, 753A and 2219 A) and five males parents (ICSV 700, HC 308, G46, HJ 541 and IS 2389) as per line x tester mating design in *kharif* season of 2014 and 2015 at Forage Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar. It is situated in semi-arid sub-tropical region at 29°10°N latitude and $75^0 46^0$E longitude with-at elevation of 215.52 m above mean sea level. Hisar has semi-arid and sub-tropical climate with hot dry summer and severe cold winter. The soil of the experimental field was sandy loam in texture, slightly alkaline in reaction (pH 8.0).

The experiment was laid out with 30 F_1 progenies and their respective parents and checks SSG 59-3 (varietal check) and CSH24MF (hybrid check) in randomized block design with three replications. Each F_1 and its parents were sown in 4 row of 5m with inter row spacing of 25 cm and plant to plant spacing of 15 cm. All the recommended practices were followed to raise good crop of sorghum during *kharif* 2014 and 2015. Data were recorded on five randomly chosen plants for two successive years for various agronomic and quality traits that affect the biomass production directly or indirectly Table: 1. The total soluble sugars (%) i.e., brix was directly scored with the help of hand refractometer. Mean of five plants for each entry for each character was calculated and used for statistical analysis.

Data was analyzed by the methods outlined by Panse and Sukhatme (1961) using mean values of five random plants in each replication from all treatments to find out the significance of treatment effect. The variation among the hybrids was further partitioned into genetic components attributable to general combining ability (GCA) and specific combining ability (SCA) following the method suggested by Kempthorne (1957).

Economic heterosis was calculated as per method suggested by Turner (1953) for forage sorghum and other traits as the deviation of F_1 values over the check variety for each trait and expressed in percentage. The percent increase or decrease of F_1 over the mid parent referred as average heterosis, while heterobeltiosis denotes the percent increase or decrease of F_1 over the better parent. Following formula have been used for estimation of economic heterosis:

Economic Heterosis (%)

$$\frac{\overline{F_1} - \overline{CC}}{\overline{CC}} \times 100$$

Where CC = mean performance of commercial cultivar

F_1 = mean performance of a cross.

Results and Discussion

Analysis of variance (Table: 2) revealed that mean sum of squares due to line x tester interaction was significant for all the characters and there is considerable amount of variation for all agronomic and quality traits under study. This indicates that the choice of parents was appropriate and genetic information obtained on the present material could form basis for exploiting it in forage hybrid breeding programme. The analysis of variance for combining ability of two years pooled data (Table 3) revealed that the mean squares for lines and testers were highly significant for most of the characters which indicates the all the females manifested differential behavior with different males.

In the present study, specific combining ability estimates exhibited higher estimates of variances (σ^2sca) as compared to general combining ability σ^2gca) and their ratio also indicated the importance of non-additive type of gene action for all the characters studied including yield, which could economically be exploited for the production of forage sorghum multicut F_1 hybrids involving male sterile lines and restore parents having high fodder yield. The lower estimates of gca:sca ratio for all characters suggested the predominant. Role of non-additive gene action and greater magnitude of variance due to specific combining ability for inheritance of these traits (Table: 3). Higher estimated of σ^2sca for yield and other characters have earlier been reported in sorghum by Yadav and Pahuja (2007), Pandey *et al.* (2013) and Dehinwal *et al.* (2017b).

In the present study, on the basis of two year hybrids evaluation programme, the general combining ability effects (Table 4) observed for various traits revealed the presence of considerable amount of additive genetic variance for fodder yield and its component characters. Among the lines, 2219A showed negative gca effects for early vigour and in testers ICSV 700 showed positive gca effects for early vigour. For green fodder yield 467A, 637A and 753A among lines and G 46, HJ 541 and IS 2389 had shown the positive gca effects. Similar results were reported by Padamshree *et al.*, 2014.

Line 637A had also shown the positive gca effects for number of tillers per plant, number of leaves /plant and leaf length. Similarly 753A had shown the positive gca effects for plant height and stem girth. Thus, amongst the lines, 637 A and 753 A were good general combiners for fodder yield and related traits like number of tillers per plant, number of leaves per plant, leaf breadth *etc.* and the lines 467A was found good general combiner for TSS. The testers HJ 541 and IS 2389 were found good general combiners for various fodder yield traits and TSS. ICSV 700 was good general combiners for early vigor.

High *sca* effects of crosses for various characters like 9A x IS2389 for green fodder yield and TSS %, 467A x HC 308 for leaf breadth, stem girth and TSS percentage, 467A x IS 2389 for green fodder yield, leaf length and TSS percentage, 2219A x G 46 for green fodder yield, leaf breadth and stem girth clearly implies that these combinations were good specific combiners during both the years (Table: 5). It was also interesting to observe that a good cross combination based on high and desirable *sca* effect was not always necessarily the result of high x high *gca* parents, rather it might occur from high x low *gca* parent, as has been observed in case of 9A x IS2389 and 467A x HC 308 for green fodder yield. Higher *sca* effects for leaf length as in the case of cross 467A x IS 2389, for number of leaves per plant in hybrid 467A x HJ 541 and for stem girth in hybrid 467A x HC 308 was due to high x high *gca* parents which reflect additive x additive type of gene interaction. The superiority of the hybrids over parents was due to the concentration of favourable genes contributed by the parents and their interaction. Crosses involving high x high or low x low *gca* parents and having high *sca* indicate additive x dominance or dominance x dominance gene interactions, respectively Dey *et al.(*2014) and Milic *et. al* (2011). Therefore, there is possibility to get highly heterotic hybrids and good transgressive segregants for fodder yield from such crosses which are attempted in this study. These results are in conformity with those obtained earlier by Singh and Shrotria (2008), Girma *et al.* (2011).

The range of heterosis for all crosses for different characters is present in Table: 6. On the basis of specific combining ability, the crosses 467A X 2389, 725A X 308, 2219A X G46 and 2219A X HJ 541 were found to be promising for yield related traits. The crosses 467A X 2389, 637AX HJ 541, 637A X HC 308 expressed significant positive relative heterosis for green fodder yield and the crosses 9A X 2389, 725A X 2389 and 753A X 2389 for TSS. The most heterotic crosses for green fodder yield per plant along with per se performance and their heterotic effects for component characters are represent in Table 5. Similarly, Akabari *et al.*(2012) also reported the presence of considerable degree of heterosis for green fodder yield per plant in forage sorghum.

The study reveals that there is lot of scope for the use of these male sterile lines in future breeding programmes in the development of either base populations or hybrids. The lines with high brix and green fodder yield can be exploited for the improvement of quality of fodder sorghum thereby enhancing the nutritive value of the crop. On overall basis of sca and standard heterosis, the cross 467A X 2389 have registered superiority in fodder yield, relater traits & TSS which can be tested at multilocation traits.

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Table 1. List of biometrical and quality traits studied for hybrids evaluation

S.No.	Biometrical traits	S.No.	Quality trait
1	Early Vigour	6	Stem girth (cm.)
2	Plant Height (cm.)	7	No. of leaves per plant
3	Plant Population/m^2	8	No. of tillers per plant
4	Leaf length (cm.)	9	Green fodder yield (q/ha)
5	Leaf breadth (cm.)	10	Regeneration
S.No.	**Quality trait**		
1	Total Soluble solids (TSS %)		

Table 2. Analysis of variance for Line x Testers for morphological and quality traits in forage sorghum

Source of variation	D.F	Early Vigour	Plant Population/m^2	Green Fodder Yield (q/ha)	Plant Height (cm)	No. of Tillers/plant	No. of Leaves/plant
Replication	2	0.063	4.033	273.268	121.618	0.758	26.978
Treatment	40	0.306*	9.268**	110331.284**	3457.945**	3.288**	50.936**
Female	5	0.114	3.267	11458.18**	971.04**	0.547	22.11**
Male	4	0.317*	0.650	14183.29**	36680.18**	1.15*	6.10*
Hybrids	29	0.326*	8.899**	110910.03**	2816.97**	3.67**	38.45**
Male x Female	10	0.346**	25.53**	8185.72*	15964.24**	0.467	76.06**
Parents x Hybrids	39	0.619**	68.17**	1074650.4**	7780.45**	17.09**	710.57**
Error	80	0.173	4.108	45.192	273.007	1.121	8.803

Table 2. Contd…..

Source of variation	D.F	Leaf Length (cm)	Leaf Breadth (cm)	Stem Girth (cm)	TSS %	Regeneration
Replication	2	7.374	0.746	1.181	1.377	0.490
Treatment	40	192.998**	5.283**	44.522**	10.312**	0.948*
Female	5	143.25**	1.60*	5.81**	0.356	0.981*
Male	4	147.04**	2.03**	8.00**	0.923*	2.733**
Hybrids	29	187.98**	5.92**	50.88**	11.126**	0.511*
Male x Female	10	575.78**	21.48**	0.016	2.00*	2.376**
Parents x Hybrids	39	388.10**	1.72*	244.06**	82.370**	4.901**
Error	80	26.214	0.594	3.829	0.361	0.246

D.F. = Degree of Freedom

* Significant at 5% level **significant at 1% level

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Table 3. Combining ability analysis for morphological and quality traits in forage sorghum

Source of variation	D.F	Early Vigour	Plant Population/m2	Green Fodder Yield (q/ha)	Plant Height (cm)	No. of Tillers/plant	No. of Leaves/plant
Replication	2	0.119	14.408	291.995	187.669	0.469	50.053
Hybrids	29	0.326*	8.899**	110910.039**	2861.971**	3.677**	38.457**
Lines	5	0.723**	12.812*	324674.356**	11066.384**	9.411**	95.769**
Tester	4	0.094	12.268*	180755.073**	1975.435**	4.176*	30.288*
Lines x Testers	10	0.273	7.246	43499.953**	988.175**	2.143	25.762**
Error	58	0.163	4.291	57.361	352.572	1.352	9.676
σ2gca	-	0.008	0.321	12679.68	335.32	0.282	2.259
σ2sca	-	0.421	12.39	269804.28	5595.299	5.475	73.102
σ2gca/ σ2sca	-	**0.019**	**0.026**	**0.046**	**0.059**	**0.051**	**0.031**

Table 3. Contd…..

Source of variation	D.F	Leaf Length (cm)	Leaf Breadth (cm)	Stem Girth (cm)	TSS %	Regeneration
Replication	2	1.300	0.498	0.464	2.756	0.136
Hybrids	29	187.986**	5.929**	50.886**	11.126**	0.511*
Lines	5	522.353**	8.550**	155.301**	21.695**	0.391
Tester	4	42.469	5.151**	28.963**	16.011**	0.101
Lines x Testers	20	133.498**	5.430**	29.167**	7.506**	0.623*
Error	58	26.533	0.643	5.101	0.333	0.288
σ^2gca	-	9.025	0.286	3.816	0.668	-0.023
σ^2sca	-	420.17	15.30	114.17	29.08	0.753
σ^2gca/ σ^2sca	-	**0.215**	**0.019**	**0.33**	**0.023**	**-0.031**

D.F. = Degree of Freedom
* Significant at 5% level **significant at 1% level

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Table 4. General Combining ability effects of parents for morphological and quality traits in forage sorghum

Female Parents	Early Vigour	Plant Population/m^2	Green Fodder Yield (q/ha)	Plant Height (cm)	No. of Tillers/plant	No. of Leaves/plant	Leaf Length (cm)	Leaf Breadth (cm)	Stem Girth (cm)	TSS %	Regeneration
9A	0.106	0.650	-149.496**	-24.189**	-0.211	-2.428	-7.033**	-0.521	-4.213**	2.033	0.056
467A	0.139	0.250	60.880**	17.611*	0.089	-0.394	3.600	-0.108	-1.474	0.617**	0.156
637A	0.139	0.317	176.035**	11.478	1.356**	4.706**	6.633**	-0.838**	-2.774**	-0.433	0.056
725A	-0.128	-1.050	-98.490**	-11.389	-0.711	-1.194	-1.800	1.356**	2.723**	-0.867**	0.56**
753A	0.139	1.650*	149.444**	38.678**	-0.811	-1.361	4.933	-0.048	2.503**	-0.017	-0.011
2219A	-0.394**	-1.217	-138.374**	-32.189**	0.289	0.672	-6.333**	0.159	3.235**	-1.333**	-0.311
SEm. (gi)	**0.1472**	**0.7564**	**2.7655**	**6.8564**	**0.4245**	**1.1359**	**1.8809**	0.2928	**0.8247**	**0.2108**	**0.1961**
Male Parents											
ICSV700	0.94**	-1.391*	-116.101**	-15.128*	0.022	-2.367*	3.872*	-0.775*	-1.532	-0.650**	0.128
HC 308	0.039	0.156	-61.813**	-2.100	-0.228	-0.422	0.178	0.469	0.376	-0.372	-0.011
G 46	-0.100	0.711	10.853**	4.178	-0.792*	-0.950	-0.683	0.419	1.814*	-0.483	-0.67**
HJ 541	-0.017	0.711	149.844**	13.706*	0.300	1.244	0.817	0.272	0.140	-0.150	-0.011
IS 2389	-0.017	-0.317	17.218**	-0.656	0.578	1.494	-2.183	-0.586	-0.798	1.656**	-0.039
SEm. (gj)	0.1344	**0.6905**	**2.5246**	**6.2590**	**0.3875**	**1.0369**	1.7170	0.2673	0.7528	0.1924	0.1790

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Table 5. Specific combining ability effects of hybrids for morphological and quality traits in forage sorghum

S.No	Hybrids	Early Vigour	Plant Population/ m^2	Green Fodder Yield (q/ha)	Plant Height (cm)	No. of Tillers/plant	No. of Leaves/plant	Leaf Length (cm)	Leaf Breadth (cm)	Stem Girth (cm)	TSS %	Regeneration
1	9A X ICSV700	0.339	0.128	-29.219**	-0.006	-0.622	-1.1	9.394*	1.335*	3.463	1.633**	-0.194
2	9A X HC308	0.061	1.211	52.923**	-6.533	0.961	3.289	-0.244	-1.176	-3.292	-0.978	0.444
3	9A X G46	-0.3	1.322	-141.05**	-9.978	-0.261	-1.017	4.117	0.991	1.481	-0.533	-0.5
4	9A X HJ 541	-0.217	-2.011	45.436**	10.161	-0.067	-1.878	-7.383	-0.362	-0.308	-1.617**	-0.056
5	9A X IS 2389	0.117	-0.65	71.909**	6.356	-0.011	0.706	-5.883	-0.787	-1.344	1.494**	0.306
6	467A X ICSV700	0.139	1.028	-72.019**	2.861	-0.089	1.367	3.761	-0.712	-1.023	-2.033**	-0.128
7	467A X HC 308	-0.472	-0.556	-67.427**	-28.333	-1.506	-3.578	-7.044	1.461*	4.996**	2.439**	-1.322**
8	467A X G46	0.167	0.056	-130.537**	-6.278	0.439	-2.05	-5.517	-2.573**	-5.035**	-2.7	-0.267
9	467A X HJ 541	-0.083	-1.944	1.946	10.028	0.8	5.256*	-1.183	0.608	-1.231	0.55	0.511
10	467A X IS 2389	0.25	1.417	268.036**	21.722	0.356	-0.994	9.983*	1.216	2.293	1.744**	0.206
11	637A X ICSV700	-0.028	-0.372	35.713**	30.994*	0.978	2.933	-8.106	-0.998	-1.663	0.017	-0.194
12	637A X HC 308	-0.139	-1.789	-20.091**	13.467	-1.272	-2.344	8.089	2.041**	3.192	0.822	0.278
13	637A X G46	0	1.489	62.445**	17.856	-0.328	3.517	2.617	-0.493	-2.062	1.433**	0.167
14	637A X HJ 541	0.83*	1.656	-53.872**	-23.672	0.2	-2.344	-0.383	0.071	1.079	0.017	0.111
15	637A X IS 2389	0.83*	-0.983	-24.196**	-21.644	0.422	-1.761	-2.217	-0.621	-0.547	-2.289**	-0.361
16	725A X ICSV700	-0.261	-0.006	56.571**	9.694	-0.289	-0.5	4.161	1.342	3.187	-0.883	0.139
17	725A X HC 308	0.128	1.244	184.127**	7.667	0.128	-1.111	2.856	-0.969	-1.791	-0.828	0.611
18	725A X G46	0.1	-1.811	9.54	0.889	0.406	0.75	-8.45*	-0.386	-0.815	1.783**	-0.333
19	725A X HJ 541	0.017	1.189	-173.21**	-25.639	-0.4	-3.611	3.05	0.111	2.539	-0.8	0.278
20	725A X IS 2389	0.017	-0.617	-77.028**	7.389	0.156	4.472	-1.617	-0.097	-3.12	0.728	-0.694
21	753A X ICSV700	0.139	-0.606	30.398**	-16.706	-0.356	-3.167	2.094	0.628	-0.48	0.517	0.206
22	753A X HC 308	-0.306	-0.189	-71.66**	28.1	-0.272	0.722	-2.878	0.201	-0.622	-0.844	-0.322
23	753A X G46	0	0.422	76.333**	-0.178	0.339	1.583	3.317	0.417	1.024	0.6	0.4
24	753A X HJ 541	0.417	2.089	81.503**	8.128	0.367	1.722	-2.683	-0.569	-0.002	0.267	-0.322
25	753A X IS 2389	-0.25	-1.717	-116.574**	-19.344	-0.078	-0.861	0.15	-0.677	0.079	-0.539	0.039
26	2219A X ICSV700	-0.328	-0.172	-21.445**	-9.839	0.378	0.467	-11.306**	-1.595*	-3.485	0.75	0.172
27	2219A X HC 308	0.728	0.078	-77.873**	-14.367	1.961*	3.022	-0.778	-1.556	-2.484	-0.611	-0.689
28	2219A X G46	0.033	-1.478	123.267**	-2.311	-0.594	-2.783	3.917	2.044**	5.409**	-0.583	0.533
29	2219A X HJ 541	-0.217	-0.978	98.197**	20.994	-0.9	0.856	8.583*	0.141	-2.077	1.583**	-0.522
30	2219A X IS 2389	-0.217	2.55	-122.147**	5.522	-0.844	-1.561	-0.417	0.966	2.637	-1.139**	0.506
	SEm. (sij)	**0.3292**	**1.6913**	**6.1839**	**15.3313**	**0.9493**	**2.5399**	**4.2058**	**.6547**	**1.8440**	**0.4713**	**0.4835**

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Table 6. Heterosis of hybrids over best check for morphological and quality traits in forage sorghum

Hybrids S.No.	1 Early Vigour	2 Plant Population/m^2	3 Green Fodder Yield (q/ha)	4 Plant Height (cm)	5 No. of Tillers/plant	6 No. of Leaves/plant	7 Leaf Length (cm)	8 Leaf Breadth (cm)	9 Stem Girth (cm)	10 TSS %	11 Regeneration
1	0.00	-30.33	-55.26*	-24.77*	-52.50	-41.63*	13.67	-8.76	40.39	150.00	-40.30
2	-8.33	-18.03	-36.19*	-18.92*	-32.50	-26.32	-2.64	-29.03*	**-6.52**	91.67	-31.34
3	-20.83*	-14.75	-53.15*	-16.37	-57.50	-40.19*	2.40	0.23	53.58	100.00*	-49.25*
4	-16.67	-31.15	-7.65*	10.36	-40.00	-36.36*	-11.99	-20.51*	20.06	81.25	-40.30
5	-8.33	-29.51	-22.49*	-6.01*	-35.00	-28.23	-14.15	-38.25*	0.97*	**204.17**	-34.33
6	-4.17	-27.87	-31.84*	15.47	-40.00	-28.71	20.86	-31.34*	23.48	22.92*	-37.31*
7	-20.83*	-28.69	-23.60*	-0.90*	-65.00*	-40.19*	2.88	13.13	100.19*	141.67*	-43.28*
8	-8.33	-22.95	-22.27*	24.62	-42.50	-37.32*	3.84	-43.32*	17.03	10.42*	-43.28*
9	-12.50	-32.79	15.68	47.90	-22.50	-10.05	12.23	-1.38	37.65	100.00*	-28.36*
10	-4.17	-21.31	**34.34***	**45.50**	-25.00	-27.27	**23.98**	-4.84	62.68	175.00	-34.33
11	-8.33	-34.43*	-0.68	19.97	-5.00*	-9.57	8.15	-45.39*	4.71*	47.92*	-40.30*
12	-12.50	-34.43*	-0.89	31.23	-42.50	-22.01	**29.02**	**11.06**	70.16	75.00	-34.33
13	-12.50	-15.57	20.81*	40.84	-35.00	-6.70	19.90	-24.65*	33.23	87.50	-37.31*
14	-8.33	-14.75	**23.98***	**12.01**	-12.50	-17.22	17.75	-18.89*	47.42	60.42	-37.31*
15	-8.33	-32.79	9.58	0.90*	-5.00*	-14.83	10.79	-40.32*	22.61	47.92*	-46.27*
16	-20.83*	-39.34*	-36.14*	-4.50*	-55.00	-36.36*	13.67	17.28	104.84*	14.58*	-34.33
17	-12.50	-26.23	-10.72*	5.41*	-52.50	-35.41*	9.35	-0.23	75.13*	22.92*	-28.36
18	-16.67	-38.52	-24.97*	4.95*	-55.00	-31.58	-8.15	7.14	98.48*	85.42	-46.27*
19	-16.67	-23.77	-31.08*	-10.36*	-52.50	-37.80*	10.55	11.98	114.74*	29.17	-34.33
20	-16.67	-37.70	-36.18*	6.46*	-40.00	-13.88	-0.48	-2.76	50.90	**112.50***	-52.24*
21	-4.17	-31.97	-5.14	16.82	-57.50	-44.50*	**20.38***	-11.98*	67.23	70.83	-34.33
22	-16.67	-22.95	-11.82	**68.92***	-60.00	-30.62	10.79	-3.46	84.32*	43.75*	-46.27*
23	-12.50	-17.21	19.03	49.10	-57.50	-29.67	**18.47**	-1.15	114.16*	77.08	-34.33
24	0.00	-9.02	39.18	65.17*	-42.50	-22.97	11.99	-16.82*	88.03*	77.08	-46.27*
25	-16.67	-32.79	-7.05	27.48	-45.00	-29.67	11.75	-30.18*	79.74*	**102.08**	-40.30*
26	-29.17*	-40.98	-52.62	-40.84*	-30.00	-28.23	-15.11	-39.86*	45.23	43.75*	-40.30*
27	-4.17	-32.79	-52.92	-33.18*	-10.00	-18.18	-2.40*	-24.88*	73.39	16.67*	-58.21*
28	-25.00*	-37.70*	-14.64*	-16.67*	-55.00	-36.36*	3.12	**24.19**	163.68*	14.58*	-37.31*
29	-29.17*	-35.25*	1.28*	12.91	-45.00	-19.62	11.99	-4.15	75.03*	77.08*	-55.22*
30	-29.17*	-22.95	-48.06	-13.96*	-40.00	-25.84	-5.28*	-4.61	111.58*	54.17*	-37.31*
Maximum	29.17	40.98	55.26	68.92	65.0	44.5	29.02	45.39	163.68	204.17	58.21
Minimum	4.17	9.02	0.68	0.9	5.0	6.7	0.48	0.23	0.97	10.42	28.36