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Heterosis and potence ratios for growth, earliness, yield and quality traits in cherry tomato (*Solanum lycopersicum* L. var. *Cerasiforme* Mill)

Parvati Pujer and Mahesh Badiger

Abstract
The experiment was conducted to estimate the heterosis and potence ratios for growth, earliness, yield and quality traits in cherry tomato (*Solanum lycopersicum* L. Var. *Cerasiforme* Mill.) by using eight lines crossed in half diallele fashion. ANOVA for diallel analysis revealed the presence sufficient genetic diversity for different traits in the experimental for mid parent heterosis obtained in both positive and negative direction. Among 28 crosses, only three crosses naming L 04780 X L 00398 (86.05 %), L 00398 X L 00196 (59.09%) and L 01696 X L 03686 (56.10 %) found to be most promising for fruit yield per plant. The estimated values of potence ratio illustrated that in most F1 crosses potence ratios had reflected, various degrees of dominance; partial- to over dominance which involved in the inheritance of these characters. In the present investigation out of 28 hybrids 17 and 18 hybrids in positive direction for plant height at 60 and 90 DAT, 10 positive for number of primary branches, 14 hybrids in negative direction (desirable) for days to first flowering, 18 hybrids in days to 50 per cent flowering, 19 hybrids in fruit yield per plant and 19 in TSS. Hybrids estimated positive or negative potence ratio with >1 value is the indication of prevalence of over dominance in desirable direction and scope for exploitation *via* heterosis breeding in cherry tomato.

Keywords: Mid parent Heterosis**,** Potence Ratio, Cherry tomato, Degree of Dominance, growth, yield and quality

Introduction

Tomato (*Solanum lycopersicum*) is one of the important Solanaceous vegetable crops of Peru-Ecuador origin (Rick, 1969) [8] and used as fresh vegetable as well as raw material for processed products such as juice, ketchup, sauce, canned fruits, puree, paste, etc. Apart from contributing nutritive elements, colour and flavour to the diet, tomatoes are also a valuable source of antioxidants, or chemo-protective compounds, and may thus be termed as "functional food". Tomato is one of the most popular and widely grown vegetables in the world ranking second important to potato in many countries. Tomato is considered as a favorite crop for research in physiology, breeding and Cytogenetics because of its wider adaptability and stability and is grown throughout the world either in outdoors or indoors. Genetic analysis provides a guide line for the assessment of relative breeding potential of the parents or identify best combiners and gene action the pace of work on development of tomato hybrid on commercial basis have been limited due to lack of superior combiners in India. Diallel analysis without reciprocal (Griffing, 1956) [2] is one of the best techniques that provide information about general and specific combining ability of the parents and at the same time, it is helpful in estimating various types of gene effects. Keeping in view the importance of the above studies, the present research program has been undertaken to estimate the mid parent heterosis and potence ratios for growth, earliness, yield and quality parameters.

Materials and Methods

The experiment was conducted at Department of Crop Improvement and Biotechnology, Kittur Rani Channamma College of Horticulture, Arabhavi. Gokak Taluk, Belgaum District, Karnataka (India) during Rabi season of 2011-2012 with eight elite lines (L 04780 (P1), L 02846 (P2), L 00398 (P3), L 00427(P4), L 01696 (P5), L 03686 (P6), L 00196 (P7) and Arka Vikas (P8)) developed from AVRDC, Taiwan. Except Arka Vikas. Hybridization was carried out in the summer season (2012), for making half diallel crosses of about 28 hybrids in unpaired parents planting arrangement.

The emasculation was carried out in the evening one day prior to opening of flower with the help of forceps. Pollen was collected next day morning from male parent and used for effecting respective crosses. The crossed fruits were retained on the plant up to maturity stage. Later, the fruits were harvested and seeds were extracted by fermentation method.
Seeds were sown on 23 November, 2012 in portray and transplanted in the field on 28 December, 2012 in RCB design with two replications. Land was prepared properly and fertilized with cow-dung, urea DAP, MOP at the rate of 10 ton, 250, 440 and 250 kg/ha, respectively. Entire amount of cow-dung DAP and MOP were applied during land preparation while urea was top dressed twice at 30 and 45 days after transplanting. Unit plot size was 7.2Sq m × 5.6 Sq m with space at 60 cm × 45 cm between row to row and plant to plant, respectively. Irrigation, weeding and other intercultural operations were done as and when necessary.

Experimental data
Five plants of each entry in each replication were randomly selected for recording the observations on 14 yield and its component characters. Data were recorded on plant height at 60 DAT (cm), plant height at 90 DAT (cm), number of branches per plant at 60 DAT, number of branches per plant at 90 DAT, days to first flowering, days to 50 per cent flowering, number of fruits per cluster, number of fruits per plant, average fruit weight (g), fruit yield per plant (Kg), fruit firmness, Total soluble sugars (TSS *Brix), ascorbic acid (mg/100g) and reducing sugars (mg/100g). The data recorded were used to analyze genetic parameters like diallele analysis ANOVA, mid parent heterosis and potence ratio.

Determination of Total soluble solids: Total soluble solids of fruit juice were determined as *Brix by using Refractometer (A.O.A.C. 1985) [1]

Determination of Ascorbic acid
Ascorbic acid (mg/100g) =

$$\frac{\text{Dye factor x Titrate value x vol.made up}}{\text{Aliquot of extraction x vol.of sample taken x sample taken}} \text{ x } 100$$

Where, dye factor =0.5

Reducing sugar (mg/100g)
Reducing sugar was estimated by DNSA (3, 5-dinitrosalicylic acid) as reagent method. Where one gram of sample is extracted in 75 per cent alcohol. Pipette suitable aliquots of stock solution (100mg D-Glucose) 100-100mg in to series of test tubes and add 0.5 ml of SNSA reagent mix gently, boil for 5 min in water bath 60^0c and cool it. The blank is adjusted at 540 nm than the series (0.1-1.2) of readings are taken as standards for samples. Standard graph is drawn and milligram of reducing sugar present in gram of solution, also expressed for 100g of sample.

Estimation of heterosis percentages
Heterosis percentages, relative to the mid-parents, for the different studied characters were calculated using the procedure illustrated by Mather and Jinks (1971) [5] as follows:

$$\text{Mid parent heterosis (\%)} = \frac{F_1 - M.P.}{M.P.} \times 100$$

where F_1 = mean value of the particular hybrid population. M.P. = mean value of the two parents for that hybrid (P1 + P2)/2.

Estimation of potence ratio
Potence ratio was calculated according to Smith (1952) [13] to determine the degree of dominance as follows:

$$P = \frac{F_1 - M.P.}{0.5\,(P_2 - P_1)}$$

Where, P: relative potence of gene set, F1: first generation mean, P1: the mean of lower parent, P2: the mean of higher parent, M.P.: mid-parents value = (P1 + P2)/2.
Complete dominance was indicated when P = +1; while partial dominance is indicated when “P” is between (−1 and +1), except the value zero, which indicates absence of dominance. Overdominance was considered when potence ratio exceeds ±1. The positive and negative signs indicate the direction of dominance of either parent.

Results and Discussion
Analysis of variance
The analysis of variance in treatments for 14 characters *viz*., plant height at 60 days after transplanting (DAT), plant height at 90 DAT, number of primary branches per plant at 60 DAT, number of secondary branches at 60 DAT, days to 50 per cent flowering, number of fruits per cluster, number of fruits per plant, average fruit weight per plant, fruit yield per plant and fruit firmness TSS, ascorbic acid and reducing sugar showed significant difference. Variance due to parents showed significant difference for all 14 characters. Variance due to hybrid showed significant difference for all the characters. Parents vs hybrids interaction showed significant difference for all the characters except number of primary branches at 60 DAT, number of secondary branches at 60 DAT and reducing sugar. Indicating that the large variation present between all the genotypes for the above 14 characters. Similar results were reported by the workers Pande *et al.* (2006) [6], Mahendrakar *et al.* (2007) [3] and Singh *et al.* (2008) [12].

Heterosis percentages (relative to the mid parent)
Estimates of mid parent heterosis for 14 characters studied is presented in the table 2. In case of cherry tomato, for earliness traits like days to first flowering (DFF) and days to 50 per cent flowering showed negative heterosis and is desirable to catch early market. Range of the mid parent heterosis was -36.43 to 8.36 for DFF and -27.62 to 3.77 for days to 50 per cent flowering. The cross L 02846 X L 00398 (-36.43) showed significantly highest negative heterosis for DFF and L 04780 X Arka Vikas (-27.62) for days to 50 per cent flowering. The negative heterosis for these traits also revealed that that the hybrids are early matured types than their parents. For growth and yield parameters like plant height

(PH) at 60 and 90 DAT, number of primary branches (NPB/P) at 60 DAT, number of secondary branches (NSB/P) at 60 DAT, number of fruits per cluster (NR/C), number of fruits per plant (NF/P), average fruit weight (AFW) and fruit yield per plant (FY/P) had a range of mid parent heterosis like -18.07 to 61.76, -5.22 to 102.56, -18.36 to 23.08, -15.38 to 39.13, -29.16 to 205.72, -59.43 to 89.60 and -41.67 to 86.05 respectively. Out of twenty eight hybrids, significantly higher positive (desirable) heterosis was observed in 26 hybrids for PH at 60 DAT, 27 hybrids for PH at 90 DAT, 20 for NPB/P, 18 for NSB/P, 20 hybrids for NF/C, 16 hybrids for NF/P, 10 hybrids for AFW and 19 hybrids for FY/P. The significantly higher positive (desirable) heterosis was observed in 27 hybrids for PH at 90 DAT with highest being recorded in L 01696 X Arka Vikas. The magnitude of heterosis over mid parent was highly significant in both the directions for above traits is the indication of varied degree of dominance involved in the inheritance of above traits. These results corroborated with findings of Marbhal *et al*. (2016) [4], Renuka and sadashiva (2016) [9], Parvati *et al.*, (2014) [7].

The cross L 04780 X L 00427 showed significant highest positive (desirable) heterosis over mid parent for NF/P. The hybrid L 00427 X L 03686 for PH at 60 DAT, L 01696 X Arka Vikas for PH at 90 DAT showed maximum mid parent heterosis. For the NPB at 60 DAT and NSB at 60 DAT the crosses L 04780 X L 02846, L 01696 X Arka Vikas recorded highest mid parent heterosis respectively. The yield parameters are more desirable in positive mid parent heterosis for the selection of good yielding hybrids. The hybrid L 04780 X L 00427 found maximum mid parent heterosis for NF/C, the cross L 02846 X L 01696 for AFW. Significant magnitude of mid parent heterosis in direction for above traits were also reported by Marbhal *et al*. (2016) [4], Renuka and sadashiva (2016) [9], Parvati *et al.*, (2014) [7].

Based on mid parent heterosis estimates of the study it was palpable that the expression of heterosis for FY/P in various hybrids associated with heterotic manifestation in some other yield contributing traits. Although, none of the hybrid showed heterotic effects for all the traits studied, three crosses naming L 04780 X L 00398 (86.05 %). L 00398 X L 00196 (59.09%) and L 01696 X L 03686 (56.10) in their order of merit found to be most promising for FY/P along with high magnitude of heterosis for other desirable traits in desired direction. Hence, these hybrids could be produced to farmers at more affordable price with high fruit yield.

Among the 14 trait studied for mid parent heterosis 4 traits were related to quality parameters namely fruit firmness (FF), total soluble sugars (TSS) ascorbic acid (AA) and reducing sugar (RS). The mid parent heterosis ranged from -32 to 36.51 for the FF with the maximum heterosis by the cross L 0.4780 X L 03686 (36.51%). Out of 28 hybrids 12 were in positive direction and remaining were in negative direction. The positive value helps in more firmness of the fruit which helps for long transportation without damage of the fruits. Similar results reported by Marbhal *et al*. (2016) [4], Renuka and sadashiva (2016) [9], Parvati *et al.*, (2014) [7].

For TSS the range was -46.31 to 176.64 and the highest mid parent heterosis by the cross L 02846 X L 00398 (176.64%). Out of 28 hybrids 19 were in positive direction and it is desirable because of sweetness in cherry tomatoes. The mid parent heterosis ranged from -43.84 to 85.92 and -74.74 to 158.75 for the AA and RS respectively. The maximum positive heterosis was found by the cross L 04780 X L 02846 for AA and L 03686 X L 00196 for RS. Among the 28 hybrids 20 hybrids for AA and 13 hybrids for RS showed positive mid parent heterosis. These hybrids with desirable values had an improved the quality parameters. Similar findings lines with the Marbhal *et al*. (2016) [4], Renuka and sadashiva (2016) [9], Parvati *et al.*, (2014) [7].

Potence ratio

The potence ratios exhibited in 28 F_1 crosses are presented in Table 3. For PH at 60 DAT, the potence ratios ranged from -54.00 (L 02846 X L 00427) to 16.53 (L 02846 X L 01696) with all twenty eight crosses indicating over dominance (>±1) and for PH at 90 DAT potence ratio ranged from -30.67(L 02846 X L 00427) to 54.75 (L 02846 X L 01696) and all crosses were (>±1) indicating over dominance inheritance. For primary branches at 60 DAT, the potence ratios ranged from -11.00 (L 04780 X L 02846 and L 04780 X L 00427) to 25 (L 04780 X L 02846), with seventeen crosses indicated over dominance (>±1) and five indicated complete dominance (+1) in the inheritance of primary branches, six hybrids were shown partial dominance (>0 to <1). For secondary branches at 60 DAT, the potence ratios ranged from -11.67 (L 00398 X L 01696) to 11 (L 01696 X L 03686), with nineteen crosses indicated over dominance (>±1), four crosses complete dominance and five indicated partial dominance (“1 to +1) in the inheritance of secondary branches. These results were similar with earlier reports of Solieman *et al*. (2013) [14], Sherpa *et al*. (2014) [11], Pemba *et al*. (2014) [8].

For days to first flowering, the potence ratios ranged from -10.64 (L 00196 X Arka Vikas) to 9.80 (L 03686 X L 00196), with twenty two crosses indicated over dominance (>±1) and five indicated partial dominance (“1 to +1) one hybrid shown complete dominance in the inheritance of days to first flowering. For days to 50 per cent flowering, the potence ratios ranged from -19.25 (L 03686 X L 00196) to 38.14 (L 04780 X L 00196), with twenty three crosses indicated over dominance (>±1) and five indicated partial dominance (“1 to +1) in the inheritance of days to 50 per cent flowering. These results were similar with earlier reports Solieman *et al*. (2013) [14], Sherpa *et al*. (2014) [11], Pemba *et al*. (2014) [8].

For yield traits like NF/C, the potence ratios ranged from -3.00 (L 01696 X L 03686 and L 02846 X L 01696) to 12.60 (L 04780 X L 00427), with eight crosses indicated over dominance (>±1), seven indicated partial dominance (“1 to +1), seven hybrid shown complete dominance (=1) and four found absence of dominance (0) in the inheritance of number fruits per cluster. Number of fruits per plant recorded the potence ratios from -3.40 (L 02846 X L 01696) to 40.73 (L 04780 X L 00427) and with ten crosses indicating over dominance (>±1) and two complete dominance (=1). For average fruit weight with the potence ratios of -3.50 (L 00398 X L 00427) to 14.09 (L 02846 X L 01696). The over dominance (>±1) was recorded by the twelve crosses and partial dominance (“1 to +1) with fifteen crosses and one cross with complete dominance (=1). The fruit yield per plant has potence ratios of -17.00 (L 01696 X L 03686) with nineteen crosses indicate over dominance (>±1), six crosses partial dominance (“1 to +1) and three crosses indicating complete dominance (=1). These results were similar with earlier reports Solieman *et al*. (2013) [14], Sherpa *et al.* (2014) [11], Pemba *et al*. (2014) [8].

The quality traits estimated for the potence ratios two know their inheritance pattern. For the fruit firmness the potence ratios ranged from -13.00 (L 00427 X L 01696) to 15 (L 00427X L 00196), with thirteen crosses indicated over dominance (>±1), fourteen indicated partial dominance (“1 to +1) and one hybrid shown complete dominance (=1) in the inheritance of fruit firmness. TSS recorded the potence ratios ranged from -4.60 (L 00398 X L 00427) to 35.00 (L 02846 X L 00196) and with nineteen crosses indicating over dominance (>±1) seven with partial dominance and one absence of dominance (=0) and one with complete dominance (=1). For ascorbic acid the potence ratios ranged from -15.02 (L 00398 X L 03686) to 17.02 (L 01696 X Arka Vikas). The over dominance (>±1) was recorded by the fifteen crosses and partial dominance (“1 to +1) with seven crosses with partial dominance (1 to +1), three cross with complete dominance (=1) and two with absence of dominance (=0). The reducing sugar has potence ratios of -93.00 (L 04780 X L 01696) to 8.89 (L 00427 X Arka Vikas) with twenty crosses indicating over dominance (>±1), eight crosses partial dominance (“1 to +1). These results were similar with earlier reports, Solieman *et al*. (2013) [14], Sherpa *et al*. (2014) [11], Pemba *et al*. (2014) [8].

Plant architectural traits like plant height, primary branches and secondary branches and traits related earliness like days to 50% flowering and days to first harvest in cherry tomato predominantly governed by non-additive variance and heterosis breeding is an advantage to exploit these traits. The potence ratios calculated in the experiment indicated that various degrees of dominance are involved in the inheritance of the studied traits in cherry tomato. In particular, partial to over-dominance were clearly involved in the inheritance of growth, earliness, yield and quality traits. These findings were similar with previous reports Solieman *et al*., 2013 [14]; Sherpa *et al*., 2014 [11] in tomato, which found a predominant role of non-additive variance components for all the studied traits, suggesting that heterosis breeding could be used for their improvement. Hybrids estimated positive or negative potence ratio with >1 value is the indication of prevalence of over dominance in desirable direction and heterosis breeding is an advantage to exploit these traits in cherry tomato.

Table 1: Mean sum of squares with respect to growth and yield characters in cherry tomato

Source of variance	Plant height (cm) 60 DAT	Plant height (cm) 90 DAT	No. primary branches	No. of secondary branches	Days to 50 per cent flower	Number of fruits /cluster	Number of fruits/plant	Average fruit wt (g)	Fruit yield/ Plant (kg)	Fruit firmness (kg)	TSS in ^{0}Brix	Ascorbic acid (mg/100g)	Reducing sugar (mg/100g)
Treatments	994.66**	1030.2 **	0.356**	2.424**	50.47**	2.682 **	29783.56**	76.35**	0.708**	1.36**	2.475**	131.571 **	14.723 **
Parents	602.1 **	624.14 **	0.360**	2.52 *	63.17 **	4.205 **	45240.06**	145.69**	0.288 **	2.04**	3.527**	101.773 **	18.983 **
Hybrids	1108.7 **	1140.3 **	0.369 *	2.38 **	47.62 **	2.328 **	26794.18 *	54.83*	0.839 **	1.11 **	2.288**	142.241 **	14.163 **
Parents Vs. Hybrids	662.35 **	899.11 **	0.0003	2.786	38.46 **	1.571 *	2301.12 *	172.01*	0.142 *	3.30**	0.142*	52.052 *	0.025
Error	46.54	42.95	0.0995	0.857	2.059	0.221	347.42	0.5882	0.023	0.042	0.0205	7.219	0.11

** and * = Significant (1 % and 5 %), DAT= Days after transplanting

Table 2: Heterosis percentages (relative to the mid parent) for 14 quantitative traits in cherry tomato

Hybrids	Plant height at 60 DAT	Plant height at 90 DAT	Number of branches at 60 DAT	No. of sec. branches at 60 DAT	Days to first flowering	Days to 50 % flowering	Number of fruits /cluster	Number of fruits/ Plant	Average fruit weight	Fruit yield/ plant	Fruit firmness	TSS %	Ascorbic acid	Reducing sugar
P1XP2	42.65	39.59	28.74	2.56	-18.89	-16.71	5.26	19.66	41.84	31.58	-20.45	137.21	85.92	-32.29
P1XP3	37.51	37.40	24.44	0.83	-20.31	-15.85	24.21	124.11	-2.72	86.05	-11.43	55.75	59.26	-47.15
P1XP4	-18.07	8.94	24.44	0.39	-28.23	-24.00	74.12	205.72	-56.20	23.81	-15.91	-17.19	65.99	-68.07
P1XP5	43.63	45.02	26.09	12.24	-26.10	-17.93	20.00	17.02	-10.27	-10.00	-32.58	-6.82	70.22	-50.00
P1XP6	32.17	36.28	6.38	9.32	-25.06	-24.29	0.00	-15.51	-4.11	-7.69	36.51	8.05	38.20	-19.51
P1XP7	47.13	46.78	7.87	7.50	-33.25	-24.29	14.29	18.18	-14.81	8.57	-8.05	9.89	28.80	-19.20
P1XP8	31.68	34.53	1.12	1.31	-35.96	-27.62	6.67	13.10	-0.48	26.09	-16.05	138.38	52.20	-37.58
P2XP3	27.19	27.02	3.45	-6.61	-36.43	-24.39	-10.91	-9.66	38.30	6.38	-2.50	176.64	-8.62	-62.47
P2XP4	38.14	36.01	-1.12	-20.31	-16.94	-21.03	0.00	-25.00	51.15	8.70	-5.05	19.67	38.63	-19.65
P2XP5	41.18	42.03	-3.30	-8.79	-25.69	-21.77	-14.29	-20.48	89.60	13.64	-5.05	2.44	12.94	4.15
P2XP6	29.30	29.47	-1.08	-6.72	-23.45	-22.40	-12.00	-9.30	37.31	20.93	31.51	43.21	15.01	44.62
P2XP7	32.57	32.17	4.55	-1.65	-20.54	-20.28	-9.09	-25.43	74.67	23.08	5.15	45.88	7.86	23.48
P2XP8	48.44	49.64	2.27	2.16	-14.15	-16.85	-12.50	-29.16	16.42	-24.00	31.87	100.00	47.54	-19.51
P3XP4	14.45	16.58	11.11	-18.35	8.36	3.77	-11.11	32.21	-19.44	5.88	-15.00	-46.31	1.96	-14.37
P3XP5	37.73	38.65	15.22	14.29	-6.11	-0.49	-4.76	-24.86	-12.92	-38.78	-8.64	-10.09	-13.73	-74.74
P3XP6	13.03	13.65	6.38	13.11	-9.48	-12.28	-4.00	0.69	-12.93	25.00	9.09	-22.22	-25.43	40.46
P3XP7	37.14	37.21	7.87	14.17	-9.07	-9.09	0.00	-2.64	12.10	59.09	-8.86	96.43	-43.84	-23.31
P3XP8	50.02	51.94	3.37	1.27	-12.31	-6.58	25.00	90.97	-31.20	27.27	9.59	103.33	0.00	-57.58
P4XP5	44.52	44.95	-17.02	-8.33	-6.01	-15.15	15.79	45.15	-48.21	-41.67	-13.13	-24.19	29.22	13.77
P4XP6	61.76	60.96	10.42	10.27	-1.01	-4.97	39.13	96.28	-59.43	6.38	23.29	-34.96	0.02	52.88
P4XP7	12.28	11.98	9.89	-5.62	-4.23	-2.37	10.00	-6.18	2.63	20.93	15.46	-14.96	-20.89	69.81
P4XP8	50.61	49.74	5.49	-11.72	-2.48	-2.93	0.00	2.88	-32.50	-29.63	20.88	114.81	-2.32	-57.97
P5XP6	41.75	43.52	-6.12	-4.56	-14.43	-6.47	-15.38	-26.12	-0.81	-37.78	21.62	30.12	30.76	52.42
P5XP7	24.11	25.40	3.23	6.94	-16.21	-2.51	-13.04	7.66	51.08	56.10	4.08	70.11	28.57	54.76
P5XP8	48.66	102.56	-1.08	23.08	-18.58	-12.50	29.41	22.17	-17.14	3.85	-4.35	161.29	39.54	37.34
P6XP7	-7.17	-5.22	-3.16	6.56	-12.44	-14.21	18.52	38.82	-16.00	15.00	-5.56	2.33	-6.81	158.75
P6XP8	18.06	19.63	-3.16	15.02	-11.68	-18.87	14.29	-4.96	-9.09	-9.80	9.09	-14.89	25.49	140.00
P7XP8	20.33	20.85	13.64	9.70	-14.83	-12.75	22.22	4.24	-18.48	-21.57	-4.44	0.00	-1.87	86.60

Table 3: Potence ratio for growth, yield and quality in cherry tomato

Hybrids	Plant height at 60 DAT	Plant height at 90 DAT	No. of branches at 60 DAT	No. of sec. branches at 60 DAT	Days to first flowering	Days to 50 % flowering	Number of fruits /cluster	Number of fruits/ plant	Average fruit weight	Fruit yield/plant	Fruit firmness	TSS %	Ascorbic acid	Reducing sugar
P1XP2	10.49	7.96	25.00	3.00	-9.59	-7.56	1.00	1.77	6.83	3.00	-1.80	19.67	4.48	-8.86
P1XP3	4.09	3.96	-11.00	0.25	2.15	2.54	4.60	11.67	-0.09	4.11	-1.00	3.00	8.00	-11.38
P1XP4	-5.38	2.35	-11.00	0.04	1.60	2.88	12.60	40.73	-2.33	1.25	-1.40	-0.61	10.33	-5.95
P1XP5	6.66	7.84	-6.00	5.80	3.91	8.08	2.00	1.00	-0.83	-0.67	-2.64	-1.50	10.99	-93.00
P1XP6	2.04	2.34	-1.00	5.50	8.58	17.67	0.00	-0.32	-0.10	-0.60	1.53	1.40	4.20	-0.39
P1XP7	3.67	3.66	-7.00	2.25	7.94	38.14	1.00	0.51	-0.52	3.00	-0.78	9.00	1.34	0.40
P1XP8	-23.00	-17.61	-1.00	-1.00	8.59	-8.32	0.33	0.44	-0.01	1.00	-4.33	19.57	6.00	2.11
P2XP3	5.30	6.03	-3.00	-2.67	3.81	2.89	-1.20	0.45	1.10	0.60	-0.11	7.00	-0.33	-13.84
P2XP4	-54.00	-30.67	0.33	-2.12	0.95	2.00	0.00	-1.56	1.72	1.00	-5.00	0.57	-2.99	-1.31
P2XP5	16.53	54.75	0.60	-7.00	3.78	4.92	-3.00	-3.40	14.09	3.00	-5.00	1.00	-1.00	1.33
P2XP6	2.48	2.77	0.14	-8.00	7.72	6.25	-0.60	-0.24	1.00	9.00	0.92	35.00	-0.54	0.84
P2XP7	3.69	4.10	-2.00	-0.67	4.77	7.13	-1.00	-1.00	3.29	3.00	5.00	7.80	-0.20	0.46
P2XP8	-8.90	-7.16	-1.00	-1.00	3.29	-15.15	-0.50	-0.74	0.30	-1.50	4.14	7.15	-4.47	-0.91
P3XP4	-2.48	-2.93	-5.00	-2.58	-1.00	-1.80	-1.00	5.73	-3.50	3.00	-0.67	-4.60	0.14	-0.93
P3XP5	-14.26	-10.41	-3.50	-11.67	-2.20	-0.12	-1.00	-0.91	-0.32	-6.33	-0.37	-0.44	-1.00	-20.71
P3XP6	1.94	2.21	-1.00	-8.00	-1.45	-2.52	-0.20	0.01	-0.20	3.00	-0.71	-0.92	-15.02	0.76
P3XP7	10.04	11.03	-7.00	6.00	-1.72	-1.62	0.00	-0.06	0.23	3.25	-0.41	4.91	-3.07	-0.46
P3XP8	-4.74	-4.57	-3.00	-0.27	-2.33	-0.69	1.00	4.61	-1.30	5.00	0.64	8.86	0.00	-2.64
P4XP5	13.92	23.15	8.00	1.00	-0.54	-2.48	1.00	2.06	-1.36	-10.00	-13.00	-0.75	14.75	1.15
P4XP6	4.94	5.17	-2.50	-1.17	-0.07	-0.71	1.29	1.84	-0.98	1.00	0.68	-1.05	0.00	-1.28
P4XP7	1.29	1.33	9.00	0.79	-0.31	-0.31	0.50	-0.16	0.05	1.29	15.00	-0.51	-0.76	-1.80
P4XP8	-10.69	-8.64	5.00	1.00	-0.18	-0.25	0.00	0.12	-1.11	-4.00	2.71	5.34	-1.00	8.89
P5XP6	4.47	4.41	3.00	11.00	-3.83	-7.67	-1.00	-0.76	-0.03	-17.00	0.62	25.00	2.00	-1.03
P5XP7	3.80	3.59	1.00	5.67	-6.47	-1.59	-3.00	0.39	3.09	4.60	2.00	20.33	-1.04	-1.13
P5XP8	-6.14	-13.33	-0.33	-6.75	-7.42	-2.26	1.00	0.50	-0.29	-0.33	-0.50	5.00	17.02	-2.03
P6XP7	2.38	1.86	-0.60	4.00	9.80	-19.25	1.67	-2.48	-1.00	1.50	-0.17	0.50	-0.54	4.31
P6XP8	-1.05	-1.13	-0.60	-5.00	9.20	-4.02	0.33	-0.07	-0.12	0.71	0.33	-1.17	1.44	3.91
P7XP8	-1.43	-1.42	6.00	-2.09	-10.64	-3.22	0.67	0.07	-0.27	-0.73	-0.67	0.00	-0.06	2.63

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