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**Qurat Ul Ain**

Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

**K Hussain**

Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

**SH Khan**

Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

**ZA Dar**

Division of GPB, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

**Nageena Nazir**

Division of Agri statistics, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

**Sajad Mohi UD Din**

Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

**SM Hussain**

Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

**S Farwa**

Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

**Correspondence****Qurat Ul Ain**

Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir, India

## Comparative performance of chilli (*Capsicum annuum* L.) genotypes under temperate conditions of Kashmir

**Qurat Ul Ain, K Hussain, SH Khan, ZA Dar, Nageena Nazir, Sajad Mohi UD Din, SM Hussain and S Farwa**

**Abstract**

In the present investigation entitled "Genetic variability and characterization studies in chilli" thirty genotypes of chilli (*Capsicum annuum* L.) were evaluated at the Experimental Farm of Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar. The observations were recorded on five randomly selected plants and mean was worked out. Wide range of variation was observed for all the traits under study. Maximum range was recorded for fruit yield qha<sup>-1</sup> (5.45-176.43), followed by number of fruits plant<sup>-1</sup> (6.40-37.40), days to harvesting (65-109), plant height (41.47-95.13 cm), plant spread (13.79-58.45 cm) and days to 50% flowering (50-84.67), while minimum range was observed for stem diameter (0.38-1.80 cm), fruit diameter (0.67-3.55 cm) and fruit pedicel diameter (0.40-0.83 cm).

**Keywords:** Chilli, comparative performance, mean, temperate condition

**Introduction**

Chilli (*Capsicum annuum* L.), (2n=2x=24) belonging to Solanaceae family, is a leading spice-cum-vegetable crop grown commercially throughout the world. It is highly valued for its green or red ripe fruits with characteristic pungency, colour and flavour. It is consumed fresh, dried or in powder form. The fruits are an excellent source of health-related phytochemical compounds, such as ascorbic acid (vitamin C), carotenoids (provitamin A), tocopherols (vitamin E), flavonoids, and capsaicinoids that are very important in preventing chronic diseases such as cancer, asthma, toothache and cardiovascular diseases. Besides it is rich in mineral salts like Ca, P and Fe. The colouring agent present in its fruits is Capsanthin (C<sub>40</sub>H<sub>56</sub>O<sub>3</sub>). The alkaloid capsaicin/capsicutin (C<sub>18</sub>H<sub>27</sub>NO<sub>3</sub>) present in placenta of the chilli fruit responsible for its pungency has diverse prophylactic and therapeutic uses in allopathic and ayurvedic medicine and can directly scavenge various free radicals. It has also acquired a great importance because of the presence of 'oleoresin', which permits better distribution of colour and flavour in foods. Chili has antioxidant, anti-mutagenesis, hypocholesterolemic and immunosuppressive properties (El-Ghoraba *et al.*, 2013) [2], inhibits bacterial growth and platelet agglomeration (Wahyuni *et al.*, 2013) [7] and facilitates starchy food digestion. Evaluation of genotypes (parents versus crosses) by estimation of mean performance per se gives an idea about their suitability to a region and provides preliminary information before initiation of any planned breeding programme. The present investigation was therefore undertaken.

**Methods**

The experimental material for the present investigation consisted of thirty diverse genotypes of chilli. The experimental material for the present investigation consisted of thirty genotypes evaluated during *Kharif* 2015 in Randomized Complete Block Design with three replications at Vegetable Experimental Farm, Division of Vegetable Science, SKUAST-Kashmir, Shalimar. The row to row and plant to plant spacing was maintained at 60 cm x 45 cm. Recommended package of practices were adopted to raise a healthy crop. The observations were recorded on twenty one quantitative parameters viz., plant height (cm), plant spread (cm), stem diameter (cm), number of branches plant<sup>-1</sup>, days to flower initiation, days to 50% flowering, days to 50% fruiting, days to harvesting, placenta length (cm), fruit length (cm),

fruit diameter (cm), fruit weight (g), fruit pedicel length (cm), fruit pedicel diameter (cm), number of fruits plant<sup>-1</sup>, fruit yield qhectare<sup>-1</sup>, dry matter content (%), vitamin C content at green stage (mg/100g), vitamin C content at red ripe stage (mg/100g), capsaicin content (mg/g) and capsanthin content (ASTA units). Observations were recorded on five randomly selected plants from each replication and mean was worked out.

## Results and discussion

The mean performance of thirty diverse genotypes of chilli for various yield and quality attributing traits is given in table 1. which clearly indicated that genotypes differed significantly for all the traits under study, however the estimates of mean values revealed that no genotype was superior for all the characters under study. Comparison of lines for plant height revealed that it ranged from 41.47-95.13 cm with an overall mean of 60.02 cm. The maximum plant height was attained by SKUA-SHC-19 (95.13) followed by SKUA-SHC-22 (90.94 cm) and SKUA-SHC-26 (90.51 cm) and minimum height was attained by SKUA-SHC-12 (41.47 cm) followed by SKUA-SHC-20 (42.90 cm) and SKUA-SHC-30 (45.36 cm). Plant spread ranged from 13.76-58.45 cm with an average value of 30.84 cm. The minimum spread was attained by SKUA-SHC-10 (13.75 cm) followed by SKUA-SHC-13 (17.44 cm) and SKUA-SHC-3(17.64 cm). The maximum plant spread was attained by SKUA-SHC-26 (58.45 cm) followed by SKUA-SHC-21 (55.37 cm) and SKUA-SHC-2 (46.15 cm). Stem diameter ranged from 0.38-1.80 cm with an overall mean of 1.083 cm. It was recorded minimum in SKUA-SHC-24 (0.38cm) followed by SKUA-SHC-18 (0.83 cm) and SKUA-SHC-28 (0.84 cm) and maximum in SKUA-SHC-19 (1.80 cm) followed by SKUA-SHC-6 (1.72 cm) and SKUA-SHC-30 (1.38 cm). Number of branches ranged from 6.00-26.40 with an overall mean of 12.02. The minimum number of branches were recorded in SKUA-SHC-1 (6.00) followed by SKUA-SHC-13 (7.47) and SKUA-SHC-2 (7.74) and the maximum number of branches plant<sup>-1</sup> were recorded in SKUA-SHC-20 (26.40) followed by SKUA-SHC-27 (23.27) and SKUA-SHC-23 (21.20). Days to flower initiation ranged from 24.00-39.60 with an average of 29.35. The minimum number of days to flower initiation were taken by SKUA-SHC-14 (24.00) followed by SKUA-SHC-20 (24.20) and SKUA-SHC-3, SKUA-SHC-4, SKUA-SHC-18 (24.40 each). The maximum number of days to flower initiation were taken by SKUA-SHC-23 and SKUA-SHC-28 (39.60 each) followed by SKUA-SHC-22 (39.40), SKUA-SHC-25 (39.27). Days to 50% flowering ranged from 50.00-85.67 with an overall mean of 67.04cm. The minimum number of days to 50% flowering were taken by SKUA-SHC-8 (50.00) followed by SKUA-SHC-30 (51.25) and SKUA-SHC-18 (51.67) and the maximum number of days to 50% flowering were taken by SKUA-SHC-26 (85.67) followed by SKUA-SHC-2 (77.37) and SKUA-SHC-5 (77.00). With an overall mean of 63.55, days to 50% fruiting ranged from 42.00-77.34. The minimum number of days to 50% fruiting were observed in SKUA-SHC-14 (42.00) followed by SKUA-SHC-3 (43) and SKUA-SHC-29 (46) and the maximum number of days to 50% fruiting were taken by SKUA-SHC-4 and SKUA-SHC-6 (77.34 each) followed by SKUA-SHC-5 (76.34) and SKUA-SHC-30 (75.34). Days to harvesting ranged from 65.00-109.0 with an overall mean of 89.71. The minimum number of days to harvest were observed in SKUA-SHC-24, SKUA-SHC-29 (65 each) followed by SKUA-SHC-3, SKUA-SHC-9, SKUA-SHC-14, SKUA-SHC-20 (66 each) and SKUA-SHC-22

(74.65). The maximum number of days to harvest was observed in SKUA-SHC-25, SKUA-SHC-30 (109) each, followed by SKUA-SHC-10, SKUA-SHC-21, SKUA-SHC-26 (108.34 each) and SKUA-SHC-4, SKUA-SHC-7, SKUA-SHC-15, SKUA-SHC-18, (106 each). Placenta length ranged from 4.60-14.54cm with an overall mean of 8.21cm. SKUA-SHC-24 attained the maximum placenta length (14.54cm) followed by SKUA-SHC-5 (13.24), SKUA-SHC-26 (11.24) and minimum placenta length was attained by SKUA-SHC-16 (4.60) followed by SKUA-SHC-10 (5.50) and SKUA-SHC-20 (6.10). Fruit length of genotypes ranged from 5.76-15.64 with an average of 9.27. The maximum length was recorded in SKUA-SHC-24 (15.64) followed by SKUA-SHC-5 (13.98) and SKUA-SHC-26 (12.20). The minimum length was recorded in SKUA-SHC-16 (5.76) followed by SKUA-SHC-10 (6.60) and SKUA-SHC-20 (7.02). Fruit diameter ranged 0.67-3.55 cm with an overall mean of 1.75 cm. SKUA-SHC-30 recorded the maximum fruit diameter (3.55 cm) followed by SKUA-SHC-15 (2.96 cm) and SKUA-SHC-24 (2.57 cm). SKUA-SHC-27 recorded the minimum fruit diameter of 0.67 cm followed by SKUA-SHC-28 (0.86 cm), and SKUA-SHC-22 (0.94 cm). Fruit weight ranged from 2.29-13.77g with an overall mean of 4.17g. Maximum weight was recorded in SKUA-SHC-24 (13.77g) followed by SKUA-SHC-11 (12.91g), SKUA-SHC-19 (10.24g) and SKUA-SHC-29 (6.02g). SKUA-SHC-17 recorded minimum fruit weight (2.29 g) followed by SKUA-SHC-21 (2.59 g) and SKUA-SHC-12 (2.64 g). Fruit pedicel length ranged from 1.95-5.50 cm with an average of 3.38 cm. SKUA-SHC-6 recorded maximum value of 5.50 cm followed by SKUA-SHC-4 (5.34 cm), and SKUA-SHC-2 (4.59 cm). The lowest value was observed in SKUA-SHC-7 (1.96 cm) followed by SKUA-SHC-12 (2.32 cm) and SKUA-SHC-10 (2.40 cm). Fruit pedicel diameter ranged from 0.40-0.83 with an average of 0.59. The maximum value was recorded in SKUA-SHC-4 (0.83) followed by SKUA-SHC-16 (0.76) and SKUA-SHC-5 (0.74). The minimum value was recorded in SKUA-SHC-9 (0.40) followed by SKUA-SHC-2, SKUA-SHC-23 (0.44 each), and SKUA-SHC-29 (0.47). Average number of fruits plant ranged from 6.40-37.40 with an overall mean of 16.84. Maximum number was recorded in SKUA-SHC-19 (37.40) followed by SKUA-SHC-24 (35), SKUA-SHC-11 (32.34) and SKUA-SHC-16 (24.40). Minimum number of fruits were recorded in SKUA-SHC-26 (6.40) followed by SKUA-SHC-25 (9.74), and SKUA-SHC-7 (10.00). Dry matter content of the genotypes ranged from 15.4-50.46% with an overall mean of 30.16%. Maximum dry matter content was recorded in SKUA-SHC-1 (50.46%) followed by SKUA-SHC-10 (50.4%) and SKUA-SHC-29 (50.33%). The minimum dry matter content was recorded in SKUA-SHC-28 (15.5%) followed by SKUA-SHC-8 (15.6%) and SKUA-SHC-2 (15.8%). Average fruit yield per hectare ranged from 5.45-176.43q with an overall mean of 26.76q. The maximum fruit yield was recorded in SKUA-SHC-24 (176.43q) followed by SKUA-SHC-11 (152.63q), SKUA-SHC-19 (140.85 q), SKUA-SHC-21 (118.09q) SKUA-SHC-22 (91.24q), and SKUA-SHC-11 (42.39q). The lowest fruit yield was recorded in SKUA-SHC-3 (5.45q) followed SKUA-SHC-6 (6.88q) and SKUA-SHC-1 (8.80q). Vitamin C content at green stage ranged from 13.28-175.75 (mg/100g) with an overall mean of 61.42 mg/100g. The maximum vitamin C content at green stage was recorded in SKUA-SHC-22 (175.75 mg/100g) followed by SKUA-SHC-21 (141.48 mg/100g), SKUA-SHC-29 (118.89 mg/100g) and SKUA-SHC-28 (109.72 mg/100g). The lowest vitamin C content at green stage was recorded in SKUA-

SHC-4 (13.28mg/100g) followed by SKUA-SHC-8 (13.48 mg/100g) and SKUA-SHC-7 (19.61 mg/100g). Vitamin C content at red ripe stage ranged from 18.78-187.37 (mg/100g) with an overall mean of 68.62 mg/100g. The highest Vitamin C content at red ripe stage was recorded in SKUA-SHC-22 (187.37 mg/100g) followed by SKUA-SHC-21 (148.64 mg/100g), SKUA-SHC-29 (134.25 mg/100g) and SKUA-SHC-23 (109.28 mg/100g). The lowest vitamin C content at ripe stage was recorded in SKUA-SHC-8 (18.78 mg/100g) followed by SKUA-SHC-4 (19.60 mg/100g) and SKUA-SHC-5 (28.28 mg/100g). In general, the vitamin C content of red chillies was found to be higher than green chillies which is in conformity with the findings of Khyadagi *et al.* (2012) and Pradhan *et al.* (2018) <sup>15, 61</sup>. Capsaicin content of the genotypes ranged from 0.201-0.620 mg/g with an overall mean of 0.368 mg/g. Highest Capsaicin content was recorded in SKUA-SHC-23 (0.62 mg/g) followed by SKUA-SHC-12 (0.57 mg/g), SKUA-SHC-15, SKUA-SHC-29 (0.56 mg/g each), and SKUA-SHC-27 (0.53 mg/g). Lowest Capsaicin content was recorded in SKUA-SHC-7 (0.20 mg/g) followed by SKUA-SHC-6 (0.23 mg/g), SKUA-SHC-5 (0.24 mg/g),

SKUA-SHC-21 (0.26 mg/g). Capsanthin content of the genotypes ranged from 45.58-188.97 units with an overall mean of 91.99 ASTA units. Highest capsanthin content was recorded in SKUA-SHC-21 (188.97units) followed by SKUA-SHC-30 (184.73units), SKUA-SHC-22 (169.82units) and SKUA-SHC-29 (168.68 units). Lowest capsanthin content was recorded in SKUA-SHC-11 (45.58units) followed by SKUA-SHC-4 (47.78 units), SKUA-SHC-10 (48.86 units), SKUA-SHC-13 (49.33 units) and SKUA-SHC-14 (54.69 units). An overall perusal of Table 1 on performance of genotypes revealed that certain genotypes exhibited superior performance for some economically important traits. SKUA-SHC -24, SKUA-SHC-11 were superior for fruit yield hectare<sup>-1</sup>, SKUA-SHC-19 was superior for plant height, stem diameter and number of fruits plant<sup>-1</sup>, SKUA-SHC-24 for fruit length, placenta length, SKUA-SHC-28 for dry matter content, SKUA-SHC-20 for days to flower initiation, SKUA-SHC-24 for fruit weight, SKUA-SHC-30 for fruit diameter, SKUA-SHC-20 for number of branches plant<sup>-1</sup>.

**Table 1:** Mean performance of genotypes for various quantitative traits in chilli (*Capsicum annum L.*)

S. No.	Genotypes	Plant height (cm)	Plant spread (cm)	Stem diameter (cm)	No. of branches plant <sup>-1</sup>	Days to flower initiation	Days to 50% flowering	Days to 50% fruiting	Days to harvesting	Placenta length (cm)	Fruit length (cm)	Fruit diameter (cm)
1.	SKAU-SHC-1	60.35	22.92	1.28	6.00	25.34	68.00	62.34	94.34	7.83	8.83	1.53
2.	SKAU-SHC-2	45.40	46.15	0.90	7.74	31.00	77.37	58.00	84.67	7.24	8.30	1.89
3.	SKAU-SHC-3	45.88	17.64	0.87	10.87	24.40	58.67	43.00	66.00	7.37	8.30	1.58
4.	SKAU-SHC-4	58.87	32.14	1.24	12.06	24.40	58.00	77.34	106.00	8.57	9.47	1.75
5.	SKAU-SHC-5	55.23	19.36	1.14	8.94	25.40	77.00	76.34	94.34	13.24	13.98	1.49
6.	SKAU-SHC-6	55.38	34.39	1.72	9.00	27.80	55.34	77.34	104.67	8.00	9.00	1.69
7.	SKAU-SHC-7	49.64	25.18	1.4	12.14	31.67	63.00	76.34	106.00	6.50	7.90	1.70
8.	SKAU-SHC-8	56.88	32.19	1.12	15.80	25.24	50.00	62.34	93.34	8.34	9.46	1.48
9.	SKAU-SHC-9	49.16	20.44	1.14	9.46	24.54	57.00	48.00	66.00	9.57	10.63	1.88
10.	SKAU-SHC-10	66.59	13.76	0.89	9.20	32.20	68.00	73.00	108.34	5.50	6.60	1.38
11.	SKAU-SHC-11	63.30	30.00	0.92	12.60	29.60	63.00	57.34	74.67	7.24	8.44	1.30
12.	SKAU-SHC-12	41.48	32.58	0.89	11.20	30.27	57.00	66.34	86.00	8.13	9.23	1.33
13.	SKAU-SHC-13	56.23	17.44	0.85	7.47	31.34	62.54	66.34	84.67	7.74	8.80	1.68
14.	SKAU-SHC-14	65.99	29.96	0.86	10.00	24.00	77.00	42.00	66.00	7.30	8.34	1.83
15.	SKAU-SHC-15	65.55	29.84	1.22	8.60	32.60	66.34	73.00	106.00	5.84	6.88	2.96
16.	SKAU-SHC-16	46.34	31.15	1.05	10.00	34.74	67.00	66.34	94.34	4.60	5.76	2.42
17.	SKAU-SHC-17	53.30	19.92	1.10	13.00	24.60	76.54	73.00	104.67	6.30	7.34	1.94
18.	SKAU-SHC-18	61.44	31.44	0.83	10.40	24.40	51.67	73.00	106.00	7.17	8.00	1.85
19.	SKAU-SHC-19	95.14	34.15	1.80	12.00	34.40	74.34	62.34	93.34	7.84	9.24	1.87
20.	SKAU-SHC-20	42.90	35.00	1.06	26.40	24.20	74.34	48.00	66.00	6.10	7.02	1.30
21.	SKAU-SHC-21	70.12	55.37	1.14	17.00	32.20	67.00	73.00	108.34	10.50	11.80	1.89
22.	SKAU-SHC-22	90.94	20.86	1.17	12.00	39.40	74.67	66.34	74.67	9.20	10.34	0.94
23.	SKAU-SHC-23	80.22	31.12	0.74	21.20	39.60	74.57	66.34	86.00	9.27	10.28	1.10
24.	SKAU-SHC-24	54.35	34.52	0.38	10.20	24.40	72.67	48.00	65.00	14.54	15.64	2.57
25.	SKAU-SHC-25	61.65	39.00	1.20	10.80	39.27	73.30	73.00	109.00	10.24	11.17	2.19
26.	SKAU-SHC-26	90.52	58.45	1.17	10.00	29.60	85.67	73.00	108.34	11.24	12.20	2.02
27.	SKAU-SHC-27	45.67	31.76	1.23	23.27	25.40	60.00	48.00	74.67	9.37	10.43	0.67
28.	SKAU-SHC-28	55.36	25.20	0.84	11.40	39.60	74.00	56.00	86.00	6.64	7.98	0.86
29.	SKAU-SHC-29	71.66	27.44	1.28	10.34	24.54	76.20	46.00	65.00	8.43	9.38	1.93
30.	SKAU-SHC-30	45.36	45.32	1.38	11.06	24.64	51.25	75.53	109.00	6.70	7.60	3.55
	CD at 5%	1.46	0.45	0.05	6.28	1.37	1.73	1.80	3.88	1.44	1.40	1.01
	SE (d)	0.73	0.23	0.025	3.14	0.69	0.87	0.90	1.94	0.72	0.70	0.50

S. No.	Genotypes	Fruit weight (g)	Fruit pedicel length (cm)	Fruit pedicel diameter (cm)	No. of fruits plant <sup>-1</sup>	Fruit yield ha <sup>-1</sup> (q)	Dry matter content (%)	Vitamin C (green) mg100 <sup>-1</sup> g	Vitamin C (ripe) mg100 <sup>-1</sup> g	Capsaicin content (mg g <sup>-1</sup> )	Capsanthin content (ASTA units)
1.	SKAU-SHC-1	2.85	4.13	0.67	11.20	8.80	50.46	33.85	45.68	0.317	72.70
2.	SKAU-SHC-2	3.86	4.59	0.44	18.67	24.90	15.80	21.5	31.34	0.296	54.54
3.	SKAU-SHC-3	5.00	2.78	0.72	11.60	5.44	39.06	57.3	65.32	0.333	72.80
4.	SKAU-SHC-4	4.84	5.34	0.83	14.34	19.52	29.33	13.28	19.6	0.32	47.78
5.	SKAU-SHC-5	4.86	2.74	0.74	14.34	19.47	19.46	23.48	28.28	0.248	58.54
6.	SKAU-SHC-6	3.84	5.50	0.66	11.14	6.88	29.26	37.4	47.4	0.235	76.49
7.	SKAU-SHC-7	5.76	1.96	0.60	10.00	9.07	29.40	19.61	31.7	0.200	99.43
8.	SKAU-SHC-8	4.40	2.99	0.59	21.54	15.45	15.60	13.48	18.78	0.316	126.14
9.	SKAU-SHC-9	4.26	3.29	0.40	11.40	37.66	15.86	51.35	47.6	0.46	64.51
10.	SKAU-SHC-10	3.66	2.40	0.72	14.14	28.29	50.40	52.15	59.99	0.313	48.86
11.	SKAU-SHC-11	12.91	2.60	0.66	32.34	152.63	39.40	24.39	47.62	0.344	45.57
12.	SKAU-SHC-12	2.64	2.33	0.66	22.47	34.60	45.86	51.70	61.32	0.578	51.21
13.	SKAU-SHC-13	4.49	2.68	0.56	20.40	17.60	35.46	48.29	62.68	0.347	49.33
14.	SKAU-SHC-14	4.07	2.90	0.74	19.60	38.67	45.46	52.58	34.62	0.27	54.69
15.	SKAU-SHC-15	3.20	3.38	0.49	21.00	15.09	35.46	77.6	61.20	0.562	73.17
16.	SKAU-SHC-16	2.72	3.80	0.76	24.40	15.65	45.26	46.84	59.61	0.448	88.30
17.	SKAU-SHC-17	2.29	3.79	0.53	11.27	22.97	47.86	41.00	85.48	0.286	82.81
18.	SKAU-SHC-18	2.72	3.18	0.74	15.00	30.68	25.87	49.57	56.4	0.490	99.05
19.	SKAU-SHC-19	10.24	3.68	0.58	37.40	140.85	25.0	58.63	50.41	0.27	104.38
20.	SKAU-SHC-20	3.86	3.87	0.67	15.00	17.93	21.0	69.5	48.95	0.360	95.38
21.	SKAU-SHC-21	2.59	4.26	0.49	21.40	118.09	20.6	141.48	148.64	0.262	188.96
22.	SKAU-SHC-22	5.24	2.80	0.50	14.34	91.29	20.6	175.75	187.36	0.330	169.82
23.	SKAU-SHC-23	4.47	3.28	0.44	20.34	16.02	20.46	101.50	109.28	0.620	129.16
24.	SKAU-SHC-24	13.77	3.69	0.60	35.00	176.43	30.20	98.15	107.48	0.31	97.81
25.	SKAU-SHC-25	5.62	2.77	0.52	9.74	15.80	20.60	67.42	76.26	0.346	92.30
26.	SKAU-SHC-26	5.36	3.00	0.54	6.40	30.81	30.33	41.24	50.62	0.334	79.52
27.	SKAU-SHC-27	3.60	3.11	0.52	12.47	9.98	15.54	47.214	57.25	0.536	74.74
28.	SKAU-SHC-28	5.56	3.98	0.52	10.60	23.92	15.40	109.72	119.3	0.262	108.70
29.	SKAU-SHC-29	6.02	2.79	0.47	13.34	38.97	50.34	118.89	134.25	0.56	168.68
30.	SKAU-SHC-30	4.57	3.77	0.53	19.00	9.46	20.00	97.61	104.24	0.506	184.73
	CD at 5%	0.79	0.62	0.09	1.57	0.59	0.46	1.79	1.79	0.006	1.83
	SE(d)	0.39	0.31	0.04	0.79	0.29	0.23	0.89	0.89	0.003	0.91

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