Impact of Plant Spacing and Plant Growth Regulators on Flowering and Fruiting Attributes of Strawberry cv. Winter Dawn Under Polyhouse Condition

Abstract

The experiment was carried out under the polyhouse of the College of Agriculture, Ummedganj Kota, Rajasthan during 2021-22 and 2022-23 to evaluate the performance of spacing and plant growth regulators on flowering and fruiting attributes of strawberry (*Fragaria×ananassa* Duch.) cv. Winter Dawn under polyhouse condition. The experiment was designed in a factorial randomized block design with involving eighteen treatment combinations comprising two plant spacing viz., 15 cm×30 cm & 30 cm×30 cm and three plant growth regulatiors viz., salicylic acid (50 ppm, 100 ppm & 150 ppm), Triacontanol (5 ppm, 10 ppm & 15 ppm) and NAA (25 ppm, 50 ppm & 75 ppm) respectively. The experiment revealed that maximum number of flowers per plant (25.08), days taken to flower initiation (34.69), duration of flowering (45.27), number of fruits per plant (24.36) and fruit set percentage (81.52%) was recorded under treatment S_2 (30 cm ×30 cm) spacing. In terms of PGRs the highest number of flowers per plant (27.11), duration of flowering (50.13), the shortest time (32.78) to flower initiation, number of fruits per plant (22.57) and fruit set percentage was (84.07%) obtained under the treatment treated with SA at 100 ppm where as, the interaction effect showed that the maximum number of flowers per plant (27.89), duration of flowering (51.81) and minimum days to flower initiation (32.00), number of fruits per plant (26.55) and fruit set percentage (84.75%) was recorded under S_2+SA_{100} ppm (30 cm ×30cm + Salicylic@100 ppm) treatment combination. It can be concluded that treatment combination of 30 × 30 cm +SA @ 100 ppm exhibited superior performance in terms of the number of flowers, duration of flower, days taken to flower initiation, number of fruits per plant and fruit set% among other treatment combinations used.

Keywords: Spacing, Plant growth regulators, Salicylic acid, Strawberry

1. Introduction:

Strawberry (*Fragaria x ananassa*Duch.) is a natural hybrid species which belongs to the Rosaceae family that is cultivated all over the world for its aggregate accessory fruits. The modern cultivated variety is a hybrid of *Fragaria virginiana* and *Fragaria chiloensis* (Hancock *et al.,*2000). The fruit is extensively cultivated in the temperate as well as subtropical regions of the world. Strawberry is an accessory fruit defined as a modified receptacle with many seeded or achenes located on it's outer surface. In India, strawberry is generally cultivated in the hills and the climatic variability that exists in these areas and the broad adaptability of the plant allow its harvesting for more than half part of the year. Strawberry, a non-climacteric, delicious fruit known for it's flavour, taste, fresh use and a rich source of vitamin C. Strawberry plants produce stolons known as runners which are the primary means of propagating strawberries commercially. Strawberry inflorescence is a modified stem called cyme terminates by a primary blossom typically followed by two secondary, four tertiary and depending on the variety and time of season eight quaternary flowers (Handley *et al.*, 1998). Flower induction in strawberry is controlled primarily by the interaction of photoperiod temperature and genotype (Darnell *et al.*, 2010). An individual flower typically has 10 green sepals five white petals 20 to 30 stamens and 60 to 600 pistils. The greatest number of pistils occurs on the primary flower and decreases successively down the inflorescence. Each pistil contains a single ovary that develops into an achene (Darnell *et al.*, 2010). The achenes (the true fruits of strawberry) together with receptacle form an aggregate fruit which is referred to as a berry (the eterio of achenes) but it is not a true berry in the botanical sense (Hancock *et al.*, 2000).

Modern cultivated strawberry is herbaceous perennial that has a central stem (crown) from which leaves, roots, stolons (runners) and inflorescences emerge. The main stem of the strawberry plant is much shortened called 'crown'.Plant spacing is crucial for ensuring excellent growth, output and quality. It contributes to ensuring adequate room for air circulation around and between the plants which lessens the spread of various diseases particularly in wet and humid conditions. It assists in achieving high output per square meter. Marketable strawberry yields are higher with closer spacing than with wider spacing but quality in respect to size & other parameters are good in wider spacing. Plant spacing is increased to promote growth and yield per plant. The leaf area and leaf area index are also improved. The greatest

harvest index and yield per square meter are provided by close spacing.Plant growth hormones are thought to be essential for many activities in the life cycle of a plant under unfavorable environmental conditions where growth ingredients alter during the growing season with corresponding fluctuations in growth and development.Salicylic acid plays a crucial role in the growth and development of the plant for crucial physiological functions such as increasing the plant's response to stress conditions (biotic and abiotic) increasing the plant's resistance to system-acquired resistance (SAR) or both. Triacontanol has been demonstrated to improve hormone functionality and root enzymatic activity when administered to plants at their peak growth period. This increases the plant's overall performance. Triacontanol essentially works by improving a plant's fundamental processes such as speeding up photosynthesis and producing more sugar or glucose. NAA hormone has many beneficial effects on plants including the ability to initiate flowering speed up, chlorophyll production, prevent fruit falling, improve crop maturity and boost agricultural yields. It can encourage the development of adventitious roots and roots of plants in addition to the basic actions of general growth hormones. It is also used to encourage the germination of seeds, the rooting of cuttings and the production of fibrous roots in agricultural crops.

2. Material and Methods

2.1 Experimental materials

The runners of the Winter Dawn variety of strawberry were brought from the strawberry farm situated in Pune (Maharashtra) in the month of November 2021–22 and 202-23. The runners were kept for two days in shade for hardening before being transplanted into well-prepared beds under poly-house conditions which were distributed randomly in three replications. Standard cultural practices were followed during the period of the experiment for cultivation of crops.

2.2 Field preparation

The experimental area was brought to a fine tilth by ploughing followed byleveling. Weeds and stones were removed from the field raised beds of 15-20 cm in height were prepared for planting the strawberry plants.The required amount of fertilizers and manures, viz., urea (80kg/ha) muriate of potash(40 kg/ha), single superphosphate (40 kg/ha) and FYM (20 tonn/ha) were calculated and applied on a plot basis before transplanting and thoroughly mixed in the beds.

2.3 Transplanting

For the experimentation, runners of strawberry cv. Winter Dawn planted on raised beds under poly-house at the different spacing of viz, 15 cm ×30 cm and 30 cm ×30 cm in the months of November (2021-22 and 2022-23) in 54 plots. Healthy tissue cultured planting materials along with ball of earth were planted carefully with a khurpi after treatment with Ridomil Gold @2 g per 1 of water on 30th November of the year 2021-22 and 2023-23 respectively. While planting, care was taken so that the crown portion of the plant do not come in contact with the soil and one-third portion of plant was above the soil. This experiment was laid out in Factorial Rendomized Block Design under 18 treatment combinations.

2.4 Mulching

To protect the strawberry plants from frost, prevent fruits from touching the ground, minimize bird attacks, conserve moisture in the soil and control weeds in the plots mulching with rice husk was done.

2.5 Preparation of plant growth regulator's solution and method of spray

(1) Based on the treatment, the solutions of three plant growth regulators, namely, salicylic acid (SA), naphthalene acetic acid (NAA) and triacontanol solutions were prepared by dissolving in the prescribed solvents. The salicylic acid (50 ppm, 100 ppm and 150 ppm), triacontanol (5ppm, 10 ppm and 15 ppm) and NAA(25 ppm, 50 ppm and 75 ppm) were prepared by weighing 50 mg, 100 mg and 150 mg of salicylic acid, 5 mg ,10 mg and 15 mg of triacontanol and 25 mg, 50 mg and 75 mg of NAA. Which were dissolved in a small quantity of methanol and made desired volume using distilled water.

2.6 Harvesting

Fruit harvesting was done when the fruits attained more than 75% color. The picking was carried out for more than one month.

2.7 Statistical Analysis

The data recorded during field experimentation and data obtained from laboratory determination were subjected to the statistical analysis of variance using factorial randomized block design and completely randomized design respectively as described by Panse and Sukhatme (1985). The overall significance of difference among the treatments was tested, using critical differences (C.D.) at 5% level of significance. The results were statistically analyzed with the help of a windows-based

computer package OPSTAT (Sheoran *et al.* 1998) which calculated the standard error of the difference in mean (SEd) and Critical difference (CD) between the treatments at 5% level of significance. Graphs were prepared by using Microsoft Excel (MS office ver. 2007).

3. Results and Discussion

3.1 Number of flowers per plant

3.1.1 Effect of spacing

In relation to different level of spacing at 90 days after transplanting, the leading number of flowers per plant measuring (24.25), (25.91) and (25.08) was documented in S_2 (30 cm ×30 cm) signifying a notable superiority over the alternative spacing levels. In contrast the minimum number of flowers per plant measuring (20.34), (21.28) and (20.81) was noted in S_1 (15 cm × 30 cm) for both individual years and in the combined data respectively. The results suggest that using a 30 cm ×30 cm spacing is more favorable than opting for a 15 cm × 30 cm. These findings are in line with the results reported by Ramamneh *et al.* (2013), Sonkar *et al.* (2012) and Sarrwy *et al.* (2012).

3.1.2 Effect of plant growth regulators (PGRs)

Among the different levels of plant growth regulators at 90 days after transplanting the highest number of flowers per plant measuring (26.92), (27.30) and (27.11) was observed in treatment treated with SA @ 100 ppm. In close succession, NAA @ 75 ppm displayed a considerable number of flowers per plant measuring (24.80), (26.18) and (25.49) for both individual years and in the combined data. However, the minimum number of flowers measuring (18.95), (20.21) and (19.58) were noted in treatment treated with TA @ 5 ppm for both individual years and in the pooled data respectively.The findings showed that using SA 100 ppm was the most successful compared to other plant growth regulators, resulting in the most positive outcomes. The current research aligns with the findings reported by Qureshi *et al.* (2013), Kazemi (2013) and Jamali *et al.* (2011).

3.1.3 Interaction effect of spacing and plant growth regulators (S × PGRs)

The combined influence of different spacing levels and plant growth regulators on number of flowers per plant at 90 days after transplanting was determined to be significant for both individual year as well as in pooled. The maximum number of flowers per plant measuring (27.66), (28.13) and (27.89) was

observed in treatment combination of S_2+SA100 ppm (30 cm ×30 cm + SA@100 ppm). In close succession, treatment combination of S_2+NAA75 ppm (30 cm × 30 cm + NAA@75 ppm) displayed measurements of (26.49), (27.92) and (27.21). In contrast, the leastnumber of flowers per plant measuring (15.65), (16.30) and (15.98) was recorded in treatment combination of S_1+TA_5 ppm (15 cm × 30 cm +TA@5ppm) for the years 2021-22, 2022-23 and in the pooled data, respectively. The present study is also in consonance with the reports of Sharma *et al.* (2020) and Jamali *et al.* (2011).

3.2 Days Taken to Initiation of Flowering

3.2.1 Effect of spacing

The initiation of flowering was significantly affected by the application of various level of spacing. Among the spacing levels early flowering occurred at (35.49), (33.88) and (34.69) days in S_2 (30 cm×30 cm). In contrast, a delayed onset of flowering at (38.40), (36.69) and (37.55) days was observed in specifically in S_1 (15 cm ×30 cm). The outcomes imply that choosing 30 cm ×30 cm spacing is better than selecting a 15 cm×30 cm spacing. The results of the present study are in conformity with the findings by Sarrwy *et al.* (2012) and Dwivedi *et al.* (2009) who reported early flowering and fruiting in wider spaced plants.

3.2.2 Effect of plant growth regulators (PGRs)

Upon examination of the data, it was evident that the application of plant growth regulators had a significant impact hastening the initiation of the flowering for both years and in pooled. In the context of various levels of plant growth regulators the timing of flowering initiation was found to be noteworthy. Early flowering, occurring at (33.65 days), (31.89 days) and (32.78 days) was observed in treatment treated with SA @ 100 ppm which was followed by NAA @ 75 ppm with a flowering initiation period of (34.20 days), (32.44 days) and (33.32 days).on the other hand, delayed flowering at (40.68 days), (38.96 days) and (39.82 days) was noted in plants treated with TA @ 5 ppm. The results indicated that application of SA 100 ppm was the most effective among various plant growth regulators, leading to the most favorable outcomes. Similar findings were reported by Eshghi *et al.* (2017)

3.2.3 Interaction effect of spacing and plant growth regulators (S × PGRs)

The duration to the initiation of flowering was found to be significantly affected by various treatment combinations for both individual year and in pooled. When considering the interactions between spacing and plant growth regulators

treatment combination S_2+SA100 ppm (30 cm ×30 cm + SA @ 100 ppm) exhibited the shortest period to flowering recording (32.88 days), (31.12 days) and (32.00 days). This was followed by treatment combination of S_2+NAA75 ppm which exhibited (33.23 days), (31.47 days) and (32.35 days) to initiate flowering. In contrast, late flowering was observed in the treatment treated with S_1+TA5 ppm (30 cm ×30 cm + TA @ 5 ppm) which took (41.28 days), (39.52 days) and (40.40 days) to initiate floweringfor both individual year and in pooled data. The present study is also in consonance with the reports of Kazemi *et al.* (2013).

3.3 Duration of Flowering (Days)

3.3.1 Effect of spacing

Among these spacing maximum duration of flowering was observed at (44.80 days), (45.74 days) and (45.27 days) in S_2 (30 cm ×30 cm). However, a minimum duration of flowering occurred at (41.95 days), (43.29 days) and (42.62 days) was noted specifically in S_1 (15 cm ×30 cm). The results suggest that using a 30 cm ×30 cm spacing is more favorable than opting for a 15 cm × 30 cm spacing. These results are in line with the findings of Hazarika *et al.* (2019) and Sarrwy *et al.* (2012).

3.3.2 Effect of plant growth regulators (PGRs)

Upon scrutinizing the data, it became apparent that the application of plant growth regulators significantly increases the duration of flowering. Considering various levels of plant growth regulators the timing of the duration of flowering was noteworthy. Maximum duration of flowering occurring at (49.44 days), (50.81 days) and (50.13 days) was observed in treatment treated with SA @ 100 ppmfollowed by NAA @ 75 ppm with a duration of flowering period of (46.81 days), (48.06 days) and (47.74 days). on the other hand, minimum duration of flowering at (38.26 days), (39.06 days) and (38.66 days) was noted in plants treated with TA @ 5 ppm for both individual year and in pooled data.The findings suggested that utilizing SA at a concentration of 100 ppm was the most successful compared to other plant growth regulators, resulting in the most positive outcomes. These findings are consistent with the results reported by Ghaderi *et al.* (2015).

3.3.3 Interaction effect of spacing and plant growth regulators (S × PGRs)

The time taken for the duration of flowering was found to be significantly influenced by various treatment combinationsfor both years and in pooled. When examining the interactions between spacing and plant growth regulators, treatment

combination of S_2+SA100 ppm (30 cm ×30 cm + Salicylic@100 ppm) demonstrated the maximum period to flowering recording (50.92 days), (52.70 days) and (51.81 days). Following closely, treatment combination of S_2+NAA75 ppm exhibited (47.59 days), (48.53 days)and (48.06 days) to duration of flowering. In contrast, minimum duration of flowering was observed in the treatment treated with S_2+TA5 ppm (15 cm ×30 cm + TA @ 5 ppm) taking (36.13 days), (36.64 days) and (36.39 days) to duration of flowering for both individual years and in the pooled data. This These findings are consistent with the results reported by Ghaderi *et al.* (2015).

3.4 Number of fruits per plant

3.4.1 Effect of spacing

Upon analyzing the data, it is apparent that different level of spacing have a distinct impact on number of fruits per plant, the highest number of fruits per plant measured at (23.03), (25.68) and (24.36) were observed in S_2 (30 cm ×30 cm) for the years 2021-22, 2022-23 and in the overall combined data.In contrast, the number of fruits per plant measured at (15.55), (17.18) and (16.37) was noted at the minimum spacing level, S_1 (15 cm ×30 cm) for the years 2021-22, 2022-23 and in the combined data, respectively. The findings indicate that a spacing of 30 cm × 30 cm is more effective than a spacing of 15 cm×30 cm. This conforms with the views of Dogar *et al.* (2020) and Shahzad *et al.* (2018).

3.4.2 Effect of plant growth regulators (PGRs)

In the assessment of different levels of plant growth regulators (PGRs) on number of fruits per plant a superior number of fruits per plant recorded at (21.07), (24.06) and (22.57) was observed with the foliar application of SA at 100 ppm in the years 2021-22, 2022-23 and the combined data respectively. Following closely, number of fruits per plant measurements of (20.91), (23.94 and (22.43) were noted with NAA at 75 ppm. In contrast, the minimum number of fruits per plant measuring (17.06), (19.47) and (18.26) was recorded with TA at 5 ppm for both individual years and in the combined data. The findings indicated that utilizing salicylic acid (SA) at a concentration of 100 ppm was more effective than employing other plant growth regulators, leading to the most favorable results in terms of plant growth and development. These findings align with the results observed by Kumar *et al.* (2019) Singh *et al.* (2001)

3.4.3 Interaction effect of spacing and plant growth regulators (S × PGRs)

The association between different spacing levels and plant growth regulators resulted significant for both individual year and in pooled. The maximum number of fruits per plant recorded at (25.09), (28.00) and (26.55) were observed in treatment combination of S_2+SA100 ppm (30 cm ×30 cm + Salicylic acid@100 ppm). Following this trend, S_2+NAA75ppm (30 cm ×30 cm + NAA at 75 ppm) exhibited number of fruits per plant (24.93), (27.87) and (26.40) for both individual years and in the combined data. On the other hand, the minimum number of fruits per plant, measuring (13.00), (14.87) and (13.93) was noted in treatment combination of S_1+TA5ppm (15 cm ×30 cm spacing + TA at 5 ppm) for the years 2021-22, 2022-23 and in the combined data, respectively. This These findings are consistent with the results reported by Mohamed *et al.* (2018)

3.5 Fruit Set %

3.5.1 Effect of spacing

Concerning examining the data, it is apparent that different level of spacing have a distinct impact on fruits set percent. The highest levels of fruit set percent, measured at 80.62% , 82.42% and 81.52% were observed in S_2 (30 cm ×30 cm) for the individual years 2021-22, 2022-23 and in pooled respectively. In contrast, the fruit set percent, measured at 78.73% , (79.81%) and (79.27%) was noted at the minimum spacing level S_1 (15 cm ×30 cm) for the years 2021-22, 2022-23 and in the combined data, respectively. The results suggest that using a 30 cm ×30 centimeter spacing is more favorable than opting for a 15 cm ×30 centimeter spacing. Research results are in accordance with the findings of Singh *et al.* (2018), Tripathi *et al.* (2000) and Sharma *et al.* (2020)

3.5.2 Effect of plant growth regulators (PGRs)

In evaluating various levels of plant growth regulators (PGRs) on the fruits set percent, a higher fruits set percent, recorded at (83.54%), (84.59%) and (84.07%) was observed with the foliar application of SA at 100 ppm in the year of 2021-22, 2022-23 and the combined data, respectively. Following closely, the fruits set percent, measuring (82.56%), (84.22%) and (83.39%) were noted with NAA at 75 ppm. In contrast, the minimum fruits set percent, measuring (75.21%), (76.33%) and (75.77%) was recorded with TA a@5 ppm for both individual years and in the combined data. The study results suggested that using salicylic acid (SA) at a concentration of 100 ppm was more successful than the use of other plant growth regulators. This resulted

in the best outcomes for the growth and development of the plants. These findings align with the results observed by Kazemi (2013) in strawberries.

3.5.3 Interaction effect of spacing and plant growth regulators (S × PGRs)

The correlation between different spacing levels and plant growth regulators significantly influenced the fruit set percent for both individual year and in pooled. The highest fruit set percent, recorded at (84.16%), (85.34%) and (84.75%) were observed in treatment combination of S_2+SA 100 ppm (30 cm ×30 cm + SA at 100 ppm). In line with this pattern, treatment combination of S_2+NAA75ppm (30 cm ×30 cm + NAA at 75 ppm) exhibited fruit set percent (83.77%), (85.07%) and (84.43%) for both individual years and in the combined data. However, the minimum fruits set percent, measuring (74.60%), (75.37%) and (74.98%) was noted in treatment combination of S_1+TA5ppm (15 cm ×30 cm spacing + TA at 5 ppm) for the years 2021-22, 2022-23 and in the combined data, respectively. This These findings are consistent with the results reported by Ghaderi *et al.* (2015).

4. Conclusion

A plant spacing of 30 cm × 30 cm combined with the application of salicylic acid at a concentration of 100 ppm demonstrated the best results regarding the number of flowers per plant, duration of flowering, time taken for flower initiation, number of fruits per plant and and fruit set %. This research can benefit farmers by showing that adjusting plant spacing and using plant growth regulators (PGRs) can effectively improve flowering characteristics, leading to more successful and profitable strawberry cultivation.

Table 1-Effect of Spacing and PGRs on Number of flowers per plant, Days taken to initiation of flowering, Duration of flowering , Number of fruits per plant and fruit set of Strawberry cv. Winter Dawn

Treatments	Number of Flowers per plant			Days taken to initiation of flowering (Days)			Duration of flowering (Days)			Number of fruits per plant			Fruit set (%)		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
	Spacing(S)														
S_1 15 × 30cm	20.34	21.28	20.81	38.40	36.69	37.55	41.95	43.29	42.62	15.55	17.18	16.37	78.73	79.81	79.27
S2 30 × 30 cm	24.25	25.91	25.08	35.49	33.89	34.69	44.80	45.74	45.27	23.03	25.68	24.36	80.62	82.42	81.52
SE(m)±	0.48	0.46	0.46	0.01	0.43	0.22	0.63	0.52	0.40	0.18	0.22	0.08	0.34	0.09	0.18
CD(P=0.05)	1.39	1.32	1.34	0.03	1.25	0.63	1.81	1.49	1.17	0.51	0.64	0.23	0.98	0.26	0.53
	Plant Growth Regulators (PGRs)														
SA 50 ppm	23.23	24.17	23.70	36.16	34.69	35.43	44.59	45.33	44.96	19.87	21.94	20.90	80.97	82.27	81.62
SA 100 ppm	26.92	27.30	27.11	33.65	31.89	32.78	49.44	50.81	50.13	21.07	24.06	22.57	83.54	84.59	84.07
SA 150 ppm	24.00	24.93	24.47	34.40	32.99	33.70	45.83	47.01	46.42	20.19	23.18	21.69	81.14	82.83	81.99
NAA 25 ppm	20.85	22.91	21.88	38.05	36.29	37.17	41.53	43.08	42.31	18.70	20.41	19.56	78.99	80.82	79.91
NAA 50 ppm	21.17	23.13	22.15	37.01	35.49	36.25	43.56	44.72	44.14	19.51	20.57	20.04	79.68	81.67	80.68
NAA 75 ppm	24.80	26.18	25.49	34.20	32.44	33.32	46.81	48.06	47.44	20.91	23.94	22.43	82.56	84.22	83.39
TA 5 ppm	18.95	20.21	19.58	40.68	38.96	39.82	38.26	39.06	38.66	17.06	19.47	18.26	75.21	76.33	75.77
TA 10 ppm	20.07	21.28	20.67	39.69	37.93	38.81	39.31	40.57	39.94	17.89	19.57	18.73	76.73	77.81	77.28
TA 15 ppm	20.66	22.27	21.46	38.68	36.91	37.80	41.02	42.03	41.53	18.46	19.76	19.11	78.23	79.49	78.86
SE(m)±	0.23	0.22	0.22	0.01	0.20	0.10	0.30	0.24	0.19	0.08	0.10	0.04	0.16	0.04	0.09
CD(p=0.05)	0.66	0.62	0.63	0.02	0.59	0.30	0.85	0.70	0.55	0.24	0.30	0.11	0.46	0.12	0.25
Treatment Combinations	Interaction effect of Spacing and PGRs														
S_1+SA 50 ppm	22.12	22.40	22.26	38.19	36.43	37.32	44.25	45.03	44.64	16.00	18.34	17.17	80.28	81.19	80.74
S_2+SA 50 ppm	24.35	25.93	25.14	34.13	32.95	33.54	44.92	45.64	45.28	23.73	25.53	24.63	81.67	83.34	82.51
S_1+ SA 100 ppm	26.18	26.48	26.33	34.42	32.66	33.55	47.96	48.92	48.44	17.05	20.12	18.59	82.92	83.84	83.38
S_2+SA 100 ppm	27.66	28.13	27.89	32.88	31.12	32.00	50.92	52.70	51.81	25.09	28.00	26.55	84.16	85.34	84.75
S_1+SA 150 ppm	22.55	22.69	22.62	35.36	33.60	34.49	45.76	46.44	46.10	16.40	19.24	17.82	80.41	81.44	80.93
S_2+SA 150 ppm	25.45	27.17	26.31	33.43	32.37	32.90	45.91	47.57	46.74	23.97	27.12	25.55	81.87	84.21	83.04
S_1+NAA 25 ppm	18.55	20.52	19.54	40.06	38.30	39.19	38.83	41.23	40.03	15.31	15.87	15.59	78.21	79.32	78.77
S_2+NAA 25 ppm	23.15	25.30	24.23	36.03	34.27	35.15	44.23	44.92	44.58	22.09	24.94	23.52	79.78	82.31	81.05
S_1+ NAA 50 ppm	18.72	20.78	19.76	39.31	37.99	38.65	42.52	44.16	43.34	15.89	16.02	15.96	79.42	80.02	79.72
S_2+NAA 50 ppm	23.61	25.48	24.55	34.71	33.00	33.86	44.60	45.27	44.94	23.12	25.12	24.12	79.95	83.31	81.63
S1+NAA 75 ppm	23.11	24.43	23.77	35.17	33.41	34.29	46.03	47.59	46.81	16.90	20.00	18.45	81.34	83.37	82.36
S2+ NAA 75 ppm	26.49	27.92	27.21	33.23	31.47	32.35	47.59	48.53	48.06	24.93	27.87	26.40	83.77	85.08	84.43
S1+TA 5 ppm	15.65	16.30	15.98	41.28	39.52	40.40	36.13	36.64	36.39	13.00	14.87	13.93	74.60	75.37	74.98
S2+TA 5 ppm	22.26	24.12	23.19	40.07	38.40	39.24	40.38	41.49	40.93	21.11	24.07	22.59	75.83	77.29	76.56
S1+TA 10 ppm	17.64	18.30	17.97	41.13	39.37	40.26	37.54	39.54	38.54	14.43	15.00	14.72	74.69	76.28	75.49
S2+TA 10 ppm	22.49	24.25	23.37	38.24	36.48	37.37	41.08	41.60	41.34	21.34	24.15	22.75	78.77	79.34	79.06
S1+TA 15 ppm	18.51	19.60	19.05	40.67	38.91	39.79	38.49	40.06	39.28	15.00	15.17	15.09	76.70	77.44	77.07
S2+TA 15 ppm	22.81	24.93	23.87	36.68	34.92	35.80	43.55	43.99	43.78	21.92	24.34	23.13	79.76	81.53	80.65
SE(m)±	0.68	0.65	0.65	0.02	0.61	0.31	0.88	0.73	0.57	0.25	0.31	0.11	0.48	0.13	0.26
CD(p=0.05)	1.97	1.87	1.89	0.04	1.77	0.89	2.55	2.11	1.65	0.72	0.90	0.32	1.38	0.37	0.75

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