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Forage Production and Quality of Lucerne (*Medicago Sativa* L.) Under Mineral Potassic Fertilization

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ABSTRACT

Livestock are one of the important components of the different region farming systems in Gujarat region. Fertilizer management affects both the productivity and nutritive value of forage legume crops. The influence of Schoenite in combination with different potassic fertilizers on fodder lucerne (Medicago sativa L.) was evaluated through field experiments at Main Forage Research Station, Anand Agricultural University, Anand on loamy sand soil during rabi season of the year 2019-2020. The plant height, Number of tillers per meter raw length at first and second cut tended to increase with the application of potassic fertilizer through soil and foliar spray. The magnitude of per cent increase in green fodder yield (101.11, 33.24 and 50.08) and dry matter yield (132.07, 67.40 and 79.49) of lucerne was found at the first and second cut as well as in total yield, respectively with response to 25 kg K_2O ha^{-1} through Schoenite + Schoenite spray @1% over the RDF + water spray. The same treatment recorded higher crude protein content and yield. The significant differences in P, K, S, and Mg content and uptake before and after spray by crop were observed due to potassic fertilization.

Keywords: *Lucerne, Green fodder yield, Potassium fertilizer, Schoenite, Dry matter, Dry matter yield, Crude Protein, Crude Protein yield, Nutrient content and Nutrient uptake*

INTRODUCTION

The livestock sector alone contributes nearly 25.8% of the value of output at current prices and the total value of output in the agriculture, fishing, and forestry sectors. The annual contribution of the livestock sector in total GDP is nearly 4.5%. For excellent forage yield, high protein content, palatable, nutritious fodder status, wider environmental adaptability and ecological benefit, lucerne has its own value as a fodder crop [6]. Lucerne is one of the most important *rabi* perennial multi-cuts fodder crops in India which provides a highly palatable nutritive protein and energy-rich green fodder [11]. In fodder, lucerne is a "queen of cultivated fodder crop or Green Gold" In India, Lucerne is the third most important fodder crop cultivated approximately in an area of one million hectare, with an annual production 60-130 t/ha [3] but is also most palatable, nutritious and has highest feeding value It is palatable green fodder contain 20-24% crude protein, 20-30% crude fiber, dry matter 18-20% along with high protein it is rich source of mineral and calcium. Lucerne is high producing nutritious legume that is well adapted to range of climates throughout the world. It is also an integral part of mixed farming systems, being mostly grown in rotation with wheat to improve the yield and protein content of grains by virtue of its high nitrogen-fixing capacity [5].

Among the major nutrients, potassium (K) is one of the three main pillars of balanced fertilizer use, along with nitrogen and phosphorus. Potassium in soil exists in several forms like soluble, exchangeable, non-exchangeable, and lattice K. Potassium play an important role in the maintenance of cellular organization by regulating the permeability of cellular membranes and keeping protoplasm in proper degree of hydration by stabilizing emulsion of high colloidal properties. Potassium has a great buffering action and stabilizes various enzyme systems. It is regulated for photosynthesis, protein synthesis and stomatal movement. It is also the major cation for the maintenance of cation-anion balances. It's beneficial action on crop quality shows better utilization of nitrogen and increased protein formation. The potassium content of soils varies widely depending upon the composition of parent rocks and minerals from which they are the degree of weathering, the climatic conditions and cropping history. The soil derived from minerals rich in potassium such as micas and feldspar have a higher native potassium.

India largely depends on the import of potassium fertilizer at the expense of heavy foreign exchange. Potassium, magnesium and sulphur are continually removed from the soil by higher-yielding crops and in the case of sulphur and magnesium often they are not replenished by many high-analysis fertilizers available in the market. Sulphur is also known as a quality element and has a basic role in several plant physiological processes. Some of the important functions that it plays include the utilization of plant nitrogen towards the synthesis of proteins and the improvement of transportation of photosynthesis to the storage organs. It also plays a key role in the activation of several enzymes involved in growth processes, starch synthesis and in nitrogen fixation. Without magnesium, chlorophyll cannot capture sun energy for photosynthesis and the important metabolic functions related to carbohydrates and cell membrane stabilization cannot be performed by the plant. Potassium is essential for the growth of lucerne and increases the yield and quality of the forage. Potassium *Schoenite* is a unique source of plant nutrition since three essential nutrients are naturally combined into one mineral.

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Since potassium appears to be a major nutritional factor affecting nitrogen accumulation and movement of carbon assimilates in the plants, its effect on symbiotic nitrogen fixation in lucerne may be critical. It has been reported that fertilization of lucerne with potassium enhances the forage yields, and persistence of the crop. An increase in yields has been reported to be a consequence of higher nitrogen fixation [1 & 2]. Nutrient management plays an important role in enhancing the yield of the crop. The standardization of optimum dose of fertilizers is to increase the production potential of herb and seed yield.

Therefore, the present study aimed to evaluate the effect of *Schoenite*, a potassic fertilizer on the morphology and productivity of this forage lucerne cultivar. Focusing on finding the best management strategies, we hypothesize that the productivity of the forage lucerne var. GAUL 2 is improved by different potassic fertilizers with different methods of application.

MATERIALS AND METHOD

Location and description of the experiment

The experiment was conducted at the Main Forage Research Station, Anand Agricultural University, Anand, Gujarat during *rabi* season of the year 2019-2020, at an altitude of about 45.1 meters above the mean sea level. The climate was sub-tropical with dry and hot summer, minimum temperature ranged from 9.7^{0}C to 22.4^{0}C while maximum temperature ranged from 22.5^{0}C to 35.6^{0}C during the crop season, and the average annual rainfall was 864 to 870 mm.

The line sowing of lucerne var. GAUL 2 (Anand 2) was done in November 2019, with the 30 × 10 cm spacing and 10 kg ha^{-1} seed rate. The lucerne was fertilized with nitrogen in each plot (25 kg N ha^{-1}), phosphorus (50 kg P_2O_5 ha^{-1}) and potassium (25 kg K_2O ha^{-1}) in the form of urea, di-ammonium phosphate and potassium sulphate, potassium chloride or potassium *Schoenite* ($K_2SO_4.MgSO_4.6H_2O$) in furrows at the time of sowing. As per the plan, the first cutting and second cutting were done after 55 DAS and 110 DAS, respectively. Attempts were made to keep the experimental field weed-free throughout the crop season. After sowing applied pre-emergence herbicide for weed management at initial stage due to initial weed control plant gets better weed-free and competition-free environment after 20 DAS one interculture operation and two hand weeding were carried out during the entire crop growth period.

The physicochemical properties of experimental soil was loamy sand-textured soil, Bulk density = 1.51 g cc^{-1}; Water holding capacity = 38.05%; pH = 7.91; EC = 0.28 dS m^{-1}; OC = 0.35%; Available P_2O_5 = 35.5 kg ha^{-1}; K_2O = 255 kg ha^{-1}; S = 8.30 mg kg^{-1}; Exchangeable Mg = 8.50 me 100g^{-1}; DTPA extractable Fe = 6.50 mg kg^{-1}; Mn = 6.10 mg kg^{-1}; Zn =0.40 mg kg^{-1}; and Cu=0.43 mg kg^{-1}.

Treatments and experimental design

The experimental design was Randomized Block Design (RBD), with three replications per treatment. The gross area of each plot was 3.60 m × 5.00 m and the net sampling area of the plot comprised 2.40 m × 4.00 m. The treatments were comprised: $\mathbf{T_1}$ (Water spray), $\mathbf{T_2}$ (*Schoenite* spray 1%), $\mathbf{T_3}$ (*Schoenite* spray 2%), $\mathbf{T_4}$ (25 kg K_2O ha^{-1} through KCl + Water spray), $\mathbf{T_5}$ (25 kg K_2O ha^{-1} through KCl + *Schoenite* spray 1%), $\mathbf{T_6}$ (25 kg K_2O ha^{-1} through KCl + *Schoenite* spray 2%), $\mathbf{T_7}$ (25 kg K_2O ha^{-1} through K_2SO_4 + Water spray), $\mathbf{T_8}$ (25 kg K_2O ha^{-1} through K_2SO_4 + *Schoenite* spray1%), $\mathbf{T_9}$ (25 kg K_2O ha^{-1} through K_2SO_4 + *Schoenite* spray 2%), $\mathbf{T_{10}}$ (25 kg K_2O ha^{-1} through *Schoenite* + Water spray), $\mathbf{T_{11}}$ (25 kg K_2O ha^{-1} through *Schoenite* + *Schoenite* spray 1%) and $\mathbf{T_{12}}$ (25 kg K_2O ha^{-1} through *Schoenite* + *Schoenite* spray 2%). The foliar application was made during crop growth period with two sprays of each *Schoenite* 1% & 2% and water spray were done at 30 and 85 DAS (days after sowing) in respective treatments and a common dose of RDF 25-50-0 NPK kg ha^{-1} was applied in each plot and K applied as per treatments.

Morphological and productive evaluation of the crop

For recording observation of growth attributes and yield attributes parameters, a random selection of five plants from net plot area and plants are tag with red colour tag. Plant height was measured using a measuring scale graded in centimeters. The height was recorded from ground level to the top of the plant from five randomly selected plants in each net plot and average was calculated and recorded separately. The total number of tillers from one-meter row length in each plot was counted at harvest and the average value was worked out for each treatment.

The dry matter yield (DMY) was recorded after harvesting the plants of each plot. Initially, the green fodder yield (GFY) was recorded as per treatment and the green fodder yield of the individual plot was weighed separately. The yield was recorded just after the harvesting with an electronic weighing balance in kilogram per plot and then converted into q ha^{-1} in both 1st and 2nd cut. At each cutting the dry matter content was determined by sampling 500g of harvested plant material from each experimental plot. The plants were taken from each plot in paper bag and sun-dried then transferred into a hot air oven for drying at a temperature of 65^{0}C to a constant dry weight. Dry matter yield (q ha^{-1}) was calculated by multiplying dry matter content (%) with total green fodder yield (q ha^{-1}).

RESULTS AND DISCUSSION

Growth and Yield

The impact of different treatments on growth, yield attributes and yield of lucerne are presented in Table 1. It was found that in first cut (55 DAS) significantly higher plant height (37.50 cm) was recorded due to treatment T_{11} (25 kg K_2O ha^{-1} through *Schoenite* + *Schoenite* spray 1%) which was statistically at par with T_5 and T_8, whereas in second cut (110 DAS), similar result (87.00 cm) obtained but T_{12} also at par with T_{11} treatment. These results were in a line with that of [16 & 7]. This increase in plant height might be due to the presence of 11% Mg in *Schoenite* plays a vital role in the vegetative growth of fodder lucerne by enhancing chlorophyll content in leaves and accumulating more photosynthates in plant tissue. Increased plant height may result from improved N fixation due to K application [2]. *Schoenite*, a potassic fertilizer, had no discernible impact on the number of tillers per meter row in the first and second cut.

In first and second cuts, treatment T_{11} (25 kg K_2O ha^{-1} through *Schoenite* + *Schoenite* spray1%) showed a significantly higher green forage yield of 61.44 q ha^{-1} and 153 q ha^{-1}, respectively and it was at par with treatments T_5 and T_8. The application of *Schoenite* (T_{11}) was recorded higher green fodder yield in the first cut by 7.11 and 6.67 q ha^{-1}, while in second cut, it was 8.67 and 14.67 q ha^{-1} as compared to KCl (T_5) and K_2SO_4 (T_8) fertilizers application respectively, (Table 1). Similarly, *Schoenite* as a potassic fertilizer caused notable variations in dry matter production. The treatment T_{11} (25 kg K_2O ha^{-1} through *Schoenite* + *Schoenite* spray 1%) had the higher dry matter yield at first and second cuts (14.18 q ha^{-1} and 44.48 q ha^{-1}, respectively), and it was comparable to treatments T_5 and T_8. The higher total green forage yield (214.44 q ha^{-1}) and dry matter yield

(58.66 q ha^{-1}) was found under the same treatment (T_{11}). The per cent increased in dry matter yield production due to T_{11} was to the tune of 13.3 and 12.8 at first cut and 6.9 and 17.4 at the second cut over T_5 and T_8, respectively. The increase in yield was due to the soil application and followed by foliar spray of *Schoenite* might be meet the nutrient requirements of fodder lucerne as compared to K_2SO_4 and KCl treatments. The chloride content of KCl might hamper the yield as compared to *Schoenite* and potassium sulphate. Moreover, results were also emphasized that foliar spray of 1% *Schoenite* could also be played vital role in plant nutrition apart from soil application of 25 kg K_2O ha^{-1} through KCl, K_2SO_4 or *Schoenite*.

The supply of the essential plant nutrients like K, S and Mg apart from N & P during growth period which possibly facilitated a steady translocation of the photosynthates to the leaves increasing yield [15]. In harmony to such findings, [14] were also reported similar results in groundnut with potassium *Schoenite* fertilization. The sulphur content of potassium *Schoenite* might also result in increasing nitrogen assimilation thereby increasing fodder yield. The results conform with those of [10], who observed that application of potassium *Schoenite* ($K_2SO_4.MgSO_4$) which increased growth and yield attributes of rice which resulted in crop yields and it was attributed to an increased rate of photosynthesis and translocation to sink.

Quality Parameters

Adding nutrients had a significant effect on the crude protein (CP) and nutrient composition of lucerne. As *Schoenite*, a potassic fertilizer, affected the crude protein content of lucerne, it was found that the various treatments had a substantial impact on the crude protein content. In first and second cuts, significantly higher crude protein content of 25.33 and 26.37 per cent was recorded in treatment T_{11} and statistically at par with treatments T_5 and T_8. Similarly, significantly higher crude protein yield of 3.57 and 11.41 q ha^{-1} was recorded due to treatment T_{11} and which was statistically at par with treatment T_5 and T_8 in first cut and with T_5 in second cut. The crude protein yield is the result of yield and crude protein content in fodder lucerne therefore similar results were obtained in both parameters reflected in crude protein yield (Table 2). Its might be due to the supplementation of K either through KCl or K_2SO_4 along with foliar spray of 1% *Schoenite* to fodder lucerne was equally effective in increasing crude protein in fodder lucerne. [8] also observed the effect of potassium on quality of blackgram. [19] revealed similar result that the sulphur increased crude protein content in berseem.

Nutrient Content

There was a significant increase in P, K, S and Mg content (Table 3) of lucerne plants when one of these nutrients was applied at different method and rate compared with no application (water spray). There was a non-significant difference in the phosphorus content of lucerne in first and second cut which received *Schoenite*, as a potassic fertilizer either through soil as well as foliar application. Before the foliar spray potassium (0.669 and 0.693), sulphur (0.333 and 0.331) and magnesium (0.295 and 0.281) content in per cent was noted in 1^{st} and 2^{nd} cut, respectively due to treatment T_{11} (25 kg K_2O ha^{-1} through *Schoenite* + *Schoenite* spray 1%). While, after foliar spray potassium (0.841 and 0.808), sulphur (0.387 and 0.392) and magnesium (0.448 and 0.456) content in per cent was recorded in 1^{st} and 2^{nd} cut, respectively with same treatment T_{11}. These results were in agreement with those of [4 & 12].

The increased K content might be due to the availability of respective element in soil due to its application and heavy utilization of K by plant for the growth of meristematic tissue and stomatal dynamics. The increase in Mg content in lucerne during both the cuts ascribed that Mg supplied through soil and foliar application of *Schoenite* (11% Mg).

Nutrient Uptake

Different potassic fertilizers were shown to be responsible for the lucerne's notable improvement in nutrient uptake (Table 4). Before spray significantly higher phosphorus (3.30 and 10.3), potassium (9.45 and 30.38), sulphur (4.70 and 14.73) and magnesium (4.15 and 12.48) uptake in kg ha^{-1} were found by the lucerne in 1^{st} and 2^{nd} cut, respectively with respect to treatment T_{11} (25 kg K_2O ha^{-1} through *Schoenite* + *Schoenite* spray 1%). While, after the spray same treatment (T_{11}) recorded significantly higher phosphorus (3.32 and 10.31), potassium (11.86 and 36.01), sulphur (5.46 and 17.47) and magnesium (6.33 and 20.33) uptake in kg ha^{-1} were observed by the lucerne in 1^{st} and 2^{nd} cut, respectively. The increased nutrient uptakes might be due the different potassic fertilizers providing better nutritional environment helps the plant to absorb more nutrients from soil consequently leading to higher photosynthates and their translocation to different plant part would have enhanced the nutrient uptake by [9 & 13]. Beneficial effect of K on the absorption of P by the crop. [17] also reported an increased in P uptake with K application. The increase in P uptake might be due to the fact potassium induced the phosphorus use efficiency in fodder lucerne and the availability of nutrients in root zone coupled with increased metabolic activity and their accumulation in vegetative plant parts led to greater translocation of these nutrients to the crop and ultimately increased the uptake. The sulphur and magnesium uptake were increased might be due to a beneficial effect of *Schoenite* in increasing yield and nutrient content resulting in increasing S and Mg uptake by lucerne. Similar results were also obtained [18]. This increase in S content in fodder lucerne plants might ascribed to increased availability of S in soil due to its application.

Conclusion

Based on this field experiment study, it is clear that the optimum dose of potassic fertilizer to lucerne improved fodder yield and nutritional quality. An application of 25 kg K_2O ha^{-1} through *Schoenite* + *Schoenite* spray @1% at 30 and 85 DAS along with RDF 25-50-00 NP kg ha^{-1} gave significantly highest growth, yield and quality as well as the nutrients content of fodder lucerne.

Data availability

The original contributions presented in the study are included in articles/supplementary material. Further inquiries can be directed to the corresponding authors.

Conflict of Interest

The authors declare that they have no known competing financial interest personal relationship that could have appeared to influence the work reported in this paper.

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Authors contribution

RB	Conceptualization, data curation, mean data analysis and investigation
KC	Review and edition, conceptualization, finalization of draft, over of monitoring of experiment
HK	Writing and editing, overall field experiment monitoring data curation, formal analysis and final analysis of data
VH	Writing of chemical part, chemical analysis and formal analysis of micronutrients data

Table 1: Effect of treatments on growth and yield of lucerne

Treat.	Plant height (cm) at harvest		Number of tillers per meter row		GFY (q/ha)			DMY (q/ha)		
	1st Cut	2nd Cut	1st Cut	2nd Cut	1st Cut	2nd Cut	Total	1st Cut	2nd Cut	Total
T_1	26.60	72.13	51.00	66.67	30.55	112.33	142.88	6.11	26.57	32.68
T_2	29.27	72.80	53.33	68.00	34.00	125.33	159.33	7.30	31.81	39.11
T_3	29.67	76.60	54.33	69.00	38.88	133.00	171.88	8.42	36.42	44.84
T_4	30.67	75.93	55.67	69.33	45.22	132.67	177.89	9.62	35.84	45.46
T_5	33.63	79.40	59.00	72.00	54.33	144.33	198.66	12.51	41.61	54.12
T_6	31.03	77.70	55.33	70.00	45.00	133.67	178.67	9.01	35.45	44.46
T_7	31.53	77.53	57.33	70.33	51.22	132.00	183.22	10.15	32.68	42.83
T_8	33.77	81.40	58.33	72.00	54.77	138.33	193.10	12.57	37.90	50.47
T_9	32.00	74.07	57.00	71.33	51.00	125.33	176.33	11.48	30.98	41.86
T_{10}	32.07	74.25	57.67	70.00	51.11	131.00	183.11	11.25	35.35	46.60
T_{11}	37.50	87.00	60.67	74.00	61.44	153.00	214.44	14.18	44.48	58.66
T_{12}	31.87	79.73	58.00	70.67	50.74	132.33	183.07	11.38	36.57	47.95
S.Em.±	1.67	2.73	2.57	2.63	3.40	6.33	-	0.67	2.59	-
C.D.0.05	4.79	7.85	NS	NS	9.78	18.18	-	1.91	7.43	-
C.V.%	9.14	6.12	7.87	6.48	12.45	8.26	-	11.16	12.64	-

Table 2: Effect of treatments on crude protein content and yield of lucerne

Treatments	Crude Protein %		Crude Protein Yield (q/ha)	
	1st Cut	2nd Cut	1st Cut	2nd Cut
T_1	19.33	17.72	1.19	4.68
T_2	22.23	21.09	1.62	6.68
T_3	22.33	21.87	1.87	7.90
T_4	22.27	21.97	2.13	7.91
T_5	24.83	23.70	3.19	10.14
T_6	22.55	22.53	2.04	8.03
T_7	22.39	22.31	2.24	7.32
T_8	24.72	24.72	3.11	9.37
T_9	22.47	22.80	2.58	7.07
T_{10}	21.94	22.30	2.47	7.84
T_{11}	25.33	26.37	3.57	11.41
T_{12}	22.06	22.36	2.52	8.16
S.Em.±	**0.95**	**1.22**	**0.15**	**0.62**
C.D.0.05	**2.72**	**3.52**	**0.46**	**1.79**
C.V.%	7.23	9.43	11.56	13.46

Table 3: Effect of treatments on of nutrients content in lucerne

Treat.	Nutrient Content (%)															
	P				K				S				Mg			
	1st Cut		2nd Cut		1st Cut		2nd Cut		1st Cut		2nd Cut		1st Cut		2nd Cut	
	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS
T_1	0.197	0.199	0.196	0.192	0.530	0.535	0.580	0.583	0.272	0.274	0.271	0.272	0.182	0.185	0.194	0.195
T_2	0.208	0.209	0.205	0.211	0.589	0.729	0.639	0.746	0.304	0.320	0.301	0.313	0.223	0.343	0.223	0.342
T_3	0.199	0.203	0.198	0.205	0.614	0.774	0.646	0.746	0.308	0.321	0.299	0.327	0.215	0.389	0.244	0.375
T_4	0.229	0.226	0.224	0.226	0.605	0.676	0.616	0.689	0.301	0.305	0.300	0.306	0.234	0.284	0.249	0.268
T_5	0.226	0.227	0.219	0.220	0.634	0.826	0.689	0.791	0.327	0.368	0.320	0.368	0.263	0.413	0.255	0.416
T_6	0.222	0.216	0.216	0.205	0.607	0.780	0.640	0.731	0.312	0.356	0.305	0.361	0.229	0.372	0.232	0.282
T_7	0.233	0.233	0.215	0.221	0.609	0.683	0.602	0.666	0.302	0.303	0.299	0.300	0.225	0.226	0.230	0.272
T_8	0.229	0.228	0.219	0.215	0.630	0.833	0.686	0.796	0.319	0.372	0.315	0.370	0.260	0.414	0.262	0.417
T_9	0.231	0.229	0.220	0.221	0.609	0.780	0.644	0.745	0.309	0.355	0.305	0.351	0.229	0.404	0.236	0.356
T_{10}	0.224	0.224	0.219	0.221	0.601	0.692	0.600	0.662	0.300	0.302	0.297	0.299	0.234	0.269	0.241	0.262
T_{11}	0.234	0.236	0.225	0.232	0.669	0.841	0.693	0.808	0.333	0.387	0.331	0.392	0.295	0.448	0.281	0.456
T_{12}	0.223	0.229	0.222	0.225	0.610	0.779	0.643	0.744	0.302	0.328	0.299	0.337	0.277	0.418	0.254	0.416
S.Em.±	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
C.D.0.05	**NS**	**NS**	**NS**	**NS**	**0.04**	**0.05**	**0.04**	**0.06**	**0.02**	**0.03**	**0.03**	**0.03**	**0.03**	**0.04**	**0.02**	**0.04**
C.V.%	7.71	3.18	5.63	6.72	3.76	4.31	3.91	5.01	4.39	5.51	5.67	5.07	7.47	6.30	5.00	6.74

· ***BFS:*** *Before Spray* · ***AFS:*** *After Spray*

Table 4: Effect of treatments on nutrients uptake by lucerne

Treat.	Nutrient Uptake (kg/ha)															
	P				K				S				Mg			
	1st Cut		2nd Cut		1st Cut		2nd Cut		1st Cut		2nd Cut		1st Cut		2nd Cut	
	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS	BFS	AFS
T_1	1.21	1.23	5.24	5.08	3.23	3.25	15.41	15.49	1.66	1.67	7.20	7.24	1.10	1.13	5.18	5.18
T_2	1.52	1.53	6.52	6.70	4.30	5.31	20.29	23.88	2.22	2.35	9.58	9.94	1.63	2.50	7.13	10.86
T_3	1.68	1.71	7.20	7.48	5.16	6.54	23.54	27.08	2.59	2.71	10.92	11.87	1.81	3.28	8.90	13.70
T_4	2.21	2.18	8.02	8.09	5.82	6.57	22.07	24.68	2.88	2.93	10.73	11.02	2.26	2.72	8.97	9.61
T_5	2.82	2.84	9.14	9.15	7.93	10.33	28.65	32.91	4.08	4.61	13.32	15.30	3.29	5.17	10.60	17.29
T_6	2.00	1.94	7.67	7.25	5.48	7.02	22.74	25.74	2.81	3.22	10.84	12.81	2.06	3.35	8.22	9.96
T_7	2.35	2.37	7.06	7.19	6.16	6.91	19.67	21.72	3.09	3.08	9.77	9.83	2.27	2.33	7.47	8.91
T_8	2.85	2.85	8.30	8.12	7.91	10.46	26.02	30.19	4.01	4.68	11.93	14.03	3.26	5.22	9.94	15.77
T_9	2.65	2.63	6.80	6.85	6.99	8.98	19.86	23.09	3.55	4.10	9.47	10.82	2.63	4.62	7.28	11.09
T_{10}	2.52	2.52	7.74	7.83	6.76	7.78	21.19	23.46	3.38	3.39	10.49	10.57	2.63	3.02	8.55	9.18
T_{11}	3.30	3.32	10.03	10.31	9.45	11.86	30.83	36.01	4.70	5.46	14.73	17.47	4.15	6.33	12.48	20.33
T_{12}	2.54	2.60	8.15	8.19	6.95	8.88	23.36	27.21	3.44	3.73	10.94	12.36	3.15	4.74	9.35	15.26
S.Em.±	**0.16**	**0.17**	**0.49**	**0.52**	**0.39**	**0.53**	**1.61**	**1.69**	**0.22**	**0.27**	**0.80**	**0.83**	**0.16**	**0.26**	**0.72**	**0.99**
C.D.0.05	**0.46**	**0.48**	**1.41**	**1.48**	**1.12**	**1.51**	**4.61**	**4.84**	**0.63**	**0.77**	**2.31**	**2.37**	**0.45**	**0.74**	**2.06**	**2.85**
C.V.%	12.03	12.57	11.15	11.64	10.67	11.67	12.19	11.25	11.79	13.22	12.85	12.00	10.79	12.14	14.31	14.02

· ***BFS:** Before Spray* ·***AFS:** After Spray*

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