SME WORLD Bureau

SafeRock® Minerals Impact on Maize Growth

SafeRock® Minerals(SRM) has been involved in numerous crop trials throughout the world and continues to demonstrate and prove its ability to increase crop yields, enhance fertiliser efficiency, re-mineralise agricultural soils, and improve the quality and nutrient content of cultivated crops. It has been certified for use in organic agriculture as a mineral soil conditioner.

Field trials examining the effect of SafeRock® Minerals on maize crops were undertaken in 2015 byDr D S Rana, Vice President of Saptrishi Vedic Agriculture Research & Development Foundation (http://www.vedic-agriculture.com).

Field Experiment

The field experiment was carried out at the Indian Agricultural Research Institute, New Delhi (IARI) research farm during *kharif* season 2015. The soil of the experimental site was typically sandy loam, flat, well drained and mildly alkaline. The experiment followed a randomized block design (RBD) with three replications. The experimental field was ploughed followed by deep harrowed and proper levelling before sowing of the maize crop on 13th July 2015. The crop was sowed after proper tillage of the experimental plots at spacing of 60 cm and 20 cm between row and plants, respectively. In each plot a uniform plant stand was maintained and standard agronomic practices were followed for raising and maintaining the crop.

The crops were harvested at maturity on 21st October, 2015 manually from ground level, and the aboveground biomass was removed from the plots. Grain and stover (leaves & stalks) samples were collected after recording the yields and sent for nutrient analysis. Post-harvest soil samples (0-15 cm depth) were also collected from all the plots for further analysis. Total nutrient uptake by the crops was computed by multiplying nutrient content with the above ground grain and stover yields.

Table 1: Treatments and crop management

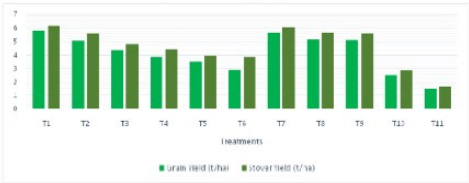
Treatment	Description
T1	NPK (100%) + SRM (100%)
T2	NPK (50%) + SRM (100%)
T3	NPK (25%) + SRM (100%)
T4	Urea (100%) + SRM (100%)
T5	FYM (50%) + SRM (100%)
T6	SRM (100%)
T7	NPK (150%)
T8	NPK (100%)+Sulphur
T9	NPK (100%)+Zinc
T10	Urea alone (100%)
	Unfertilized (Control)

Here, 50, 100 or 150% denote the percentage of the soil-test based recommended fertiliser dose. The 100% NPK rate for maize was 150-33-50 kg/ha. Urea, diammonium phosphate and muriate of potash were used to supply N, P and K, respectively, except in T_8, where single superphosphate was used as P fertilizer to supply P and S. In T_9, Zn was applied through zinc sulphate.

Table 2: Mean yields of maize (t/ha) under different fertilizer treatment

Treatment	Yield (t/ha)	
	Grain	Stover
T_1- NPK (100%) + SRM (100%)	5.84	6.15
T_2- NPK (50%) + SRM (100%)	5.07	5.58
T_3- NPK (25%) + SRM (100%)	4.37	4.81
T_4- Urea (100%) + SRM (100%)	3.88	4.40
T_5- FYM (50%) + SRM (100%)	3.53	3.98
T_6- SRM (100%)	2.94	3.88
T_7- NPK (150%)	5.63	6.02
T_8- NPK (100%)+Sulphur	5.16	5.64
T_9- NPK (100%)+Zinc	5.12	5.59
T_{10}- Urea alone (100%)	2.53	2.88
T_{11}- Unfertilized (Control)	1.56	1.69

Fig. 1. Grain and stoveryields of maize (t/ha) under different treatments



From the overall trial results obtained, the maximum yields of maize grain and stover were produced by applying NPK (100%) + SRM (100%), closely followed by NPK (150%) alone. The presence of SRM in the soil increases the efficiency of the 100% NPK fertiliser application, to produce a yield that is even higher than by applying an extra 50% NPK to the soil. Both treatments outperformed all other tested fertiliser additions.

When observing the total nutrient uptake by the crops (see Table 3), again the NPK (100%) + SRM (100%) treatment is closest to the 150% NPK treatment. It requires an extra 50% addition of NPK fertiliser to match the efficiency gains seen with the SRM treatment. Comparing all 100% NPK treatments, SRM outperforms all others in the study -

Table 3: Total nutrient uptake by crop under different treatments in maize 2015.

Treatment	Total nutrient uptake (kg/ha)				
	N	P	K	S	Zn
T_1- NPK (100%) + SRM (100%)	115.8	15.0	86.7	11.4	0.421
T_2- NPK (50%) + SRM (100%)	99.6	13.6	64.8	8.0	0.301
T_3- NPK (25%) + SRM (100%)	81.2	10.6	48.2	6.0	0.228
T_4- Urea (100%) + SRM (100%)	79.7	10.4	58.8	8.1	0.250
T_5- FYM (50%) + SRM (100%)	67.7	8.8	44.7	5.4	0.204
T_6- SRM (100%)	66.7	8.8	46.8	5.9	0.212
T_7- NPK (150%)	124.8	16.8	90.9	10.5	0.282
T_8- NPK (100%)+Sulphur	88.6	11.6	59.2	12.7	0.301
T_9- NPK (100%)+Zinc	95.8	12.4	65.6	7.8	0.430
T_{10}- Urea alone (100%)	63.8	8.3	42.7	4.6	0.243
T_{11}- Unfertilized (Control)	34.2	4.5	21.7	2.8	0.134

they do not come close to matching the total nutrient uptake levels of N, P and K seen when SRM is present with the 100% NPK.

When the same NPK (100%) + SRM (100%) grain yield is compared with alternative NPK plus micronutrient supplements such as sulphur or zinc, SRM outperforms them by 13.2% and 14.1% respectively. Even with sulphur or zinc supplementation alongside 100% NPK, the same yields were obtained when SRM was present with only 50% NPK (grain: 5.16, 5.12 and 5.07 t/ha; stover: 5.64, 5.59 and 5.58 t/ha respectively) – with SRM in the soil the same yield could be achieved with HALF the NPK fertiliser, and without additional micronutrient supplementation!

Many farmers choose to apply only urea to their fields as a nitrogenous fertiliser. This is not an optimum fertiliser strategy, but it is one that is often employed in practise so it was included in the trial. Using urea alone at 100% of the recommended amount produced a grain yield of 2.53 t/ha. By adding SRM (100%) to the same urea application, increased grain yield to 3.88 t/ha, an increase of 53.4%

SafeRock® Minerals is most effective when used to increase the efficiency of applied fertilisers, whether inorganic or organic. However, it was interesting to see that when onlySRM was applied to the soil a grain yield of 2.94 t/ha resulted. Compared with the unfertilised control grain yield of 1.56 t/ha, showed that SRM by itself increased grain yield by 88.5%! The stover yield increased by a huge 130%! This demonstrates the impressive beneficial impact that SafeRock® Minerals can have upon an agricultural soil.

By adding farmyard manure at a rate of 1000kg/acre (50% recommended amount) to the 100% SRM plot, increased the yield still further by an extra 20.1% showing that SRM is an excellent addition to organic farming systems.

Samples of soil, maize grain and maize stover were all taken from the Indian Agricultural Research Institute, New Delhi (IARI) farm for analysis.

Table 4: Status of Micro-nutrients in maize grain:

Treatments	Zinc (Zn)	Copper (Cu)	Manganese (Mn)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Boron (B)
	mg/kg				percent (%)		mg/kg
T_1- NPK (100%) + SRM (100%)	38.26	4.46	9.14	101.86	0.013	0.12	1.23
T_2- NPK (50%) + SRM (100%)	29.45	3.61	7.40	80.44	0.012	0.11	1.18
T_3- NPK (25%) + SRM (100%)	28.25	3.55	6.88	92.56	0.012	0.09	0.98
T_4- Urea (100%) + SRM (100%)	31.17	3.04	7.24	91.39	0.012	0.10	0.88
T_5- FYM (50%) + SRM (100%)	25.54	3.26	6.84	78.35	0.011	0.11	0.93
T_6- SRM (100%)	30.66	3.87	8.45	96.58	0.013	0.12	0.93
T_7- NPK (150%)	32.80	3.65	7.26	91.64	0.010	0.11	1.09
T_8- NPK (100%)+Sulphur	28.12	3.08	7.13	78.66	0.011	0.10	1.09
T_9- NPK (100%)+Zinc	46.85	3.67	8.26	100.36	0.012	0.13	1.05
T_{10}- Urea alone (100%)	33.80	3.54	7.22	88.76	0.010	0.12	0.94
T_{11}- Unfertilized (Control)	31.22	3.83	7.84	84.50	0.009	0.08	0.82

Table 5: Status of Micro-nutrients in maize straw:

Treatments	Zinc (Zn)	Copper (Cu)	Manganese (Mn)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Boron (B)
	mg/kg				percent (%)		mg/kg
T_1- NPK (100%) + SRM (100%)	57.86	9.12	57.26	348.03	0.53	0.44	4.89
T_2- NPK (50%) + SRM (100%)	49.24	8.34	53.69	283.91	0.51	0.42	4.32
T_3- NPK (25%) + SRM (100%)	41.30	9.02	53.47	261.55	0.52	0.43	4.09
T_4- Urea (100%) + SRM (100%)	47.84	8.15	55.06	249.28	0.49	0.43	4.33
T_5- FYM (50%) + SRM (100%)	45.89	7.42	51.30	245.88	0.46	0.44	4.29
T_6- SRM (100%)	43.47	8.12	54.03	260.43	0.51	0.39	4.06
T_7- NPK (150%)	50.17	9.07	60.28	311.43	0.49	0.40	4.12
T_8- NPK (100%)+Sulphur	45.57	8.22	49.82	278.36	0.46	0.41	4.28
T_9- NPK (100%)+Zinc	69.76	8.78	55.95	272.08	0.50	0.42	4.53
T_{10}- Urea alone (100%)	49.80	8.34	56.44	255.65	0.48	0.39	4.07
T_{11}- Unfertilized (Control)	49.59	8.60	50.68	252.21	0.41	0.31	3.88

The plant tissue results again showed that with the NPK (100%) + SRM (100%) treatment, not only were yields maximised, but the final crop harvest was more nutritious, being the most consistently high in secondary macro and micro-nutrient content than the alternate treatments. Individual micronutrient supplements performed well in their own single element nutrient analysis, but SafeRock® Minerals with its broad spectrum of micronutrient content and clay mineral efficiencies, invariably outperformed them in all other elements of nutrient content, as well as being superior in yield.

SafeRock® Mineralsis currently undergoing numerous field trials all over the world at the highest levels of educational, governmental and corporate involvement. We look forward to sharing the results of these trials in due course.

For more information on SafeRock® Minerals, and to request full trial information please visit www.saferockminerals.com or contact:

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