Title: The introduction of the K^+ Booster into the Eastern Cape Agricultural System.

Project Collaboration: Eastern Cape Department of Rural Development and Agrarian Reform & Biological Agricultural Era Proprietary Limited.

Locality: Bizana, Eastern Cape, South Africa.

Scope: The collaborative project between the Eastern Cape Department of Rural Development and Agrarian Reform & Biological Agricultural Era Proprietary Limited serves as a pilot project to integrate a novel organic plant bio-stimulant (K^+ Booster) to augment plant productivity (growth & yield), and the sustainability of the emerging farmers paradigm in the Eastern Cape.

Abstract: South Africa faces an imminent challenge of doubling the agricultural produce by 2050 to satisfy the projected increase in food demand. This situation is further exacerbated by the global influence on fertilizer prices, unconducive climatic conditions, the nocuous long-term effects of over-fertilization to counter soil infertility, and limited access to innovative biological technologies. Biological Agricultural Era Proprietary Limited proposes the usage of advanced agricultural practices to enhance the socio-economic structure of the Eastern Cape through the introduction and integration of a propitious organic plant bio-stimulant (K^+ Booster). The proposed model aims to create a new market space with the South African agricultural sector that enables for the export of high-value organic produce. The study was conducted on the staple crops of maize, beans, and onions in four cooperative farms in the region of Bizana, Eastern Cape. The K^+ Booster significantly influenced the plant growth of all test crops and increased the final yield of maize (24%), beans (51%), and onions (38%) respectively, in relation to untreated plants. The study further showed a positive impact on the profitability of the cooperative farms as there was a reduction inputs coupled with larger harvest values. The following pilot project illustrates that the integration of the K^+ Booster serves as feasible and efficient vector that can employ agriculture to effect positive change in socio-economic aspects of South Africa.

Methods: To migrate to sustainable and organic practices, no chemical fertilizer was employed. The soils had been treated with manure-based compost two weeks prior to the start of the study. Maize and beans seeds had been purchased from Mcdonald Seeds, and onion seedlings purchased from Sunshine Seeds. Seedlings and seeds were treated on the day of planting by spraying the soil. Growth Kinetics for maize and beans seeds were measured by

means of germination index, number of leaves, stem length, and stem width. Onion seedlings growth parameters were quantified by number of leaves. Crops were sprayed every 10 days at 6am when stomatal conductance was at the highest. The study was completed when all produce had been harvested and analyzed. A One-Way ANOVA statistical test was utilized on R-Studio to determine the biological significance of the K^+ Booster on the test crops. Control plants were untreated and each test crop was studied in replicates N=20.

Results and Discussion: The K^+ Booster contains a myriad of constituents (amino acids, proteins, polymers, nutrients, carbohydrates, anti-oxidants, flavonoids, and phenolic compounds) that are encapsulated in nano-particle form. The specific pH of the product enhances the absorption of the biological compounds through the stomata of the plant. The application of the K^+ Booster significantly enhanced the growth patterns of test crops resulting in larger plants of higher productivity (Data Omitted). This elevated crop productivity correlates to the augmentation in final yield. The final yield of maize, beans and onions were 24%, 51% and 38% respectively, in relation to the control. The effect of the K^+ Booster on the seed germination index indicates a significant statistical difference (p = 0.000). The enzymatic activity of the K^+ Booster enhances the sucrose metabolism of the seed, thereby, promoting seed respiration and reducing germination time. In addition, amino acids such as tryptophan serves as the precursor to the hormone auxin. This increased the seeds metabolism and physiological vigor. The high concentration of potassium within the K^+ Booster indirectly influences the synthesis of chlorophyll and activation of RuBisCo and ATP synthase. The increase in ATP synthase enables for higher energy levels within the plant that is channeled into photosynthesis. The potassium compounds further serve as an osmolyte and stimulates stomatal conductance. This facilitates the movement of biological compounds and carbon dioxide in the plant. This increased the plants carbon fixation levels, net productivity, and correlates to the augmented plant growth. The higher yield values can be attributed to the molecular stimulation and augmentation of the plant metabolisms.

Conclusion: The following study illustrates that the introduction of “molecular farming” into the agricultural system of South Africa serves as novel biological technique to enhance crop yields. This pilot study can be extrapolated into numerous cooperative farms in South Africa and improve the quality and financial resources of emerging farmers and surrounding communities.

References:

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