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FRONTLINE DEMONSTRATION OF FOLIAR SPRAY OF BIO PESTICIDE ON SUGARCANE (*Saccharum officinaruml* CV.) CO 0238, IN BHADOHI DISTRICT OF UTTAR PRADESH, INDIA

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ABSTRACT: The present study was conducted by Directorate of Extension, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, during 2022-23 and 2023-24 in the Rabi season with demonstrations on Sugarcane covering an area of 5.50 hectare in Bhadohi district of Uttar Pradesh in India to exhibit the effect of foliar spray demonstrationof bio extract (SUGRON H) in controlling phytoplasmic, viral and other genetic disorders in sugarcane variety CO0238. This variety had been a boon both for farmers and sugar industry because of its high yield and sugar recovery. For sugarcane denudation this study is important as it shows the path for the control of cane diseases as GSD, RSD< sugarcane yellows, sugarcane wilt and red rot by boosting immune system of sugarcane plants. Plots sown with hot water treated seed sets further treated with mercury were kept as control. From the demonstrations, it was observed that the improved sugarcane variety Co 0238 recorded the higher yield 950 q/ha to 985 q/ha from the field treated with botanical extract SUGRON H and compared to control in which the yield ranged between 895 q/ha and 937 q/ha sprays of Sugron-H were done after seed treatment at 30-35 days in the treated plots. Fungal management was done by thiophanate methyl and Radomil 75 WP in the control plots. The Trial was conducted in year 2022-2023. The higher production of sugarcane was with botanical extract SUGRON H as compared to the use of chemicalfungicides used on the basis of "as and when required". The increase in the demonstration yield over control plots was 5.42%. The extension gap, technology gap and technology index were recorded 51.50 q/ha, 2232.50 q/ha and 69.72%, respectively. The increment in yield of sugarcane crop under demonstrations was due to foliar spray of bio extract (SUGRON H) *viz.* seed treatment with SUGRON H. Use of bio extract SUGRON H gave higher mean net return of R s. 155650.00 per hectare with a benefit cost ratio 1.01 as compared to chemical fungicides (Rs. 142170.00 per hectare benefit cost ratio 0.94).

KEY WORDS*:* Field demonstration, sugarcane, yield, extension gap, technology, index, BC ratio.

In India, agriculture forms the backbone of the economy, as it contributes a high proportion of the country's net domestic product (FAO, 2018). The ever-increasing demand for food, feed, and fibers, and the limitation of arable land necessitate not only novel practices of preserving, managing, and enriching natural resources, but also an up scaling of land-use-efficiency. Soil forms the basis for any crop production activity and is the most precious natural resource. Declining soil fertility is one of the primary factors that directly affect crop productivity (Singh *et al.*, 2012; Dey *et al.*, 2017). Therefore, soil fertility management is crucial to ensure productivity and nutritional security, while maintaining soil health and sustainability.

India is the second largest producer of sugarcane ***(Saccharum officinarum)*** in the world (FAO, 2018). Thus, sugarcane is one of the most important cash crops in India, influencing the overall socio-economic development of the farming community (Nandhiniand Padmavathy, 2017). Cultivation of sugarcane in India dates back to the Vedic period.The earliest mention of sugarcane cultivation is found in Indian writings dated to about 1400-1000 B.C. Currently, sugarcane makes up about 7% of the total agricultural output value and occupies about 2.6% of India's gross cropped area (FAO, 2005). Sugarcane also providesraw material for the second largest agro-based industry after textiles, supporting more than 500 sugar factories with a total annual sugar production capacity of about 24.2 million Mg (DSD, IMOA, 2013). one of the most important cash crops in India, influencing the overall socio-economic development of the farming community (Nandhini and Padmavathy, 2017).

Sugarcane is a tall perennial plant growing erect up to 5-6 m and producing multiple stems. The plant is composed of four principal parts: root system, stalk, leaves and inflorescence. Sugarcane is a C4 plant, which is highly efficient at converting and storing solar energy into sucrose. The crop's global distribution is restricted to the warm strip between 37ºN and 31ºS, extending from tropical to sub-tropical zones. Sugarcane is a long duration crop, which produces huge amounts of biomass, requiring large quantities of water, and is typically grown in loamy soils. It has essentially four phases of plant development: germination, tillering, growth, and maturation/ripening. Optimum temperature for sproutingof stem cuttings is 32° to 38°C. Higher temperatures reduce the rate of photosynthesis, increase plant respiration, and productivity sharply declines. Under 25ºC, cane growth declines significantly and sucrose accumulation is favored. Low temperatures, in the range of 12-14°C, are desirable for ripening, though the plant is susceptible to frost. Sugarcane is also vulnerable to water logging and drought.

In India, sugarcane is cultivated all over the country from latitude 8 to 33ºN, excluding cold hilly areas. Indian sugarcane production is roughly divided between tropical and sub-tropical regions, which significantly differ in crop environment, management, and consequently in yield levels. In the sub-tropical zone, Uttar

Pradesh is the leading state in sugarcane production area but second for yield levels (DSD, IMOA, 2013). Sugarcane farmers in Uttar Pradesh have faced additional challenges in recent years as weather patterns, droughts, and flooding have been more extreme. For example, spring and early summer temperatures have increased high above normal thresholds, with extended drought periods. The pattern of the monsoon season has also changed, with more flooding events. In addition, frost events have become more frequent.

Bio extract are made from the substances that control pests by non-toxic mechanisms. Bio extract consist of various plant extracts, microbial extract, bio chemicals generated from microbes and other natural sources. These are usually made by growing and concentrating naturally existing organisms and their metabolites, such as bacteria and other microorganisms, fungus, nematodes, etc. These are frequently considered vital components of IPM programs and have gained a lot of practical attention as alternatives to chemical and synthetic extract (Glare et al 2012). Bio extract could be dived from arsenals (eg, nematodes), plants such as Chrysanthemum, Azadirachta (Neem), and microorganisms (eg, Bacillus thurningenes, Trichoderma, Pseudomonas), and include living organisms (natural enemies their product (phytochemicals, microbial products) which can be used for the management of pest injurious (Mazid *et al* 2011) The potential benefits of the utilization of bio-extract in agriculture and public health programs are considerable The present paper provides an overview of bio extract and their classification formulations application, current status and prospects.

Bio extracts are extracts denied from microorganisms or natural products that control pests through different mechanisms of action (Tijani *et al,* 2016), Plants, insects and microorganisms are the primary sources of bio extract which are cheaper, readily available, demonstrate various modes of action and are degradable. They are products or by products derived from microorganisms (Bacillus thuringiensis, Verticillium lecanii), insects (Trichogramma spp.), animals (nematode), plant parts or extracts (Azadirachta indica). In the past few decades, bio extract are the best substitute against chemical and synthetic extract in managing pests. They are currently used in the post and pre harvest control of diseases and crop pests (Yadav, 2017, Kour et al, 2020). Bio extracts are target-specific and are nontoxic to the environment and humans. The mode of action of bio extract is specific and operates by targeting pests nowadays; bio extract has played a vital role in the agro-market and is widely utilized in organic farming (Nawaz *et al,* 2016).

MATERIALS AND METHODS

The line demonstration of foliar spray of bio extract Sugron-H on sugarcane were conducted by the Directorate of Extension, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, during cane season 2022-23 on farmer's field of adopted villages in Bhadohi district of Uttar Pradesh, India. An area of 5.5 ha was covered withplot size 0.25 ha under frontline demonstration with active participation of 20 farmers. Before conducting impact of demonstration, a list of farmers was prepared from group meeting and specific skill training was imparted to the selected farmers regarding different aspects of cultivation etc. were followed as suggested by Choudhary (1999) and Venkattakumar *et al.* (2010). Material for the present study with respect to FLDs and control has been given in table-1. Comparison was made between 4 sprays with seed treatment of SUGRON H botanical plant immunity booster and chemical fungicide on 'as and when required" basis and the seed set hot water treatment and inoculation with mercury...Field days were also held in each cluster to exhibit farmers from the same village and other villages, the outcomes of front-line demonstrations. In general, the soil of the district is sandy loam in texture, with low organic carbon (0.02–0.46%), available phosphorus (9–11 kg/ha) and medium to high in potash. Demonstration plots were located in different villages and had different soil structures and fertility.

BIO PESTICIDE (SUGRON H)

Bio Extract (**SUGRON H**) is made by Hari Organic Manure Limited, Janakpuri, district Saharanpur. Sugron H is an extract of herbs. Sugron-H controls cane diseases as GSD, RSD, sugarcane yellows, sugarcane wilt, sugarcane rust and red rot by boosting the immune system in sugarcane plants. 4 to 5 sprays followed after seed treatment generallygive good results.

Hot water treated cane sets, further treated with mercury are taken as the planting material for control plots. The demonstration plot seed sets are treated with SUGRON-H @ 20 ml per litre water. Seed sets are dipped in this solution for 30 minutes before sowing. Sugron-H sprays with concentration of 500ml, 750ml and 1000 ml are made at 30-35 days interval. One more spray may be repeated in case of late attack. While on control side use the chemical fungicides such like thiophanate methyl and Redomil fungicide in the control plots on "as and when required" basis. A visit of farmers and extension functionaries was organized at demonstration plots to disseminate the message at large scale. The demonstration farmers were facilitated by Directorate of Extension Scientists in performing field operations like sowing, weeding, irrigation, spraying, bio extract **(SUGRON-H)** and harvesting etc. during the course of training and visit. The necessary steps for selection of site and farmers, layout of demonstration etc. were followed as suggested by Choudhary (1999). The traditional practices were maintained in case of local checks. The data were collected from both front line demonstration plots as well as control plots and finally the extension gap, technology gap and technology index were worked out (Samui *et al.,* 2000) as given below:

Technology Gap = Potential yield – Demonstration yield.

Table- 1 : Distinctions between the demonstration package of practices and farmerpractices

S.No.	Particular	Demonstration Plots	Control plots
1	Farming Situation	Irrigated	Irrigated
2	Improved Variety	Co 0238	Co 0238
3	Optimum seed rate	50000 three eyed buds per ha	50000 three eyed buds per ha
4	Sowing Method	Line Transplanting (90 cm.x20cm.)	Line Transplanting (90 cm.x20cm.)
5	Seed Treatment	Seed treated with SUGRON H	Hot water treatment + mercury
6	Insect management	Chemical control	Same as in treated
7	Application of Fertilizers	N:P:K @ 120:60:40 Kg/ha.	N:P:K @ 120:60:40 Kg/ha.
8	Weed Management	Thiobencarb @ 1.25 kg/ha as pre-emergence weedicide	Thiobencarb @ 1.25 kg/ha as pre-emergence weedicide
9	Disease management	SUGRON H	Thiophanate methyl, Radomil 75 WP as and when required.

RESULTS AND DISCUSSION

The crop yield of sugarcane obtained the years under recommended practices as well as farmer's practice is presented in table 2. The crop yield of sugarcane ranged from 950q/ha to 985 q/ha with mean yield of 967.50 q/ha under recommended practice use ofregular SUGRON-H fungicides on farmer's field as against a yield ranged from 895.00 q/ha to 937.0 q/ha with a mean of 916.0 q/ha recorded under farmer's practice with chemical fungicides. In comparison to farmers practice, there was an increase of 5.79 %and 4.87 % higher grain yield of sugarcane crop, respectively during 2023 and 2024 following recommended practice. The higher production of sugarcane crop yield obtainedunder recommended practice was due to the use of improved variety, recommended seed treated with bio extract, *i.e.* **SUGRON-H** and recommended fertilizer dose, pre- emergence weed management etc. The similar results of yield enhancement in sugarcane crop impact of demonstration have been documented by Yadav *et al*. (2017) and Singh *etal*. (2012).

Extension and technology gap and Technological index (%)

The extension gap showed an increasing trend. The extension gap ranging between 55.00 q/ha to 48.00 q/ha by use of botanical extracts SUGRON-H Fungicide. The technology gap is the difference between the demonstration yield and potential yield. The technology gapwas ranged between 2250.00 q/ha and 2215.00 q/ha reduce due to use of SUGRON-H botanical fungicide and also increase the production of Sugarcane during the study period. This frightening tendency of the use of chemical fungicides that prevails in the mind of the farmer can be easily overpowered by the use of botanical pesticides in the cultivation of Sugarcane. These findings are similar to the findings of Gilespie *et al*. (2017). Technology index showed the feasibility of evolved technology at the farmer's field. The lower is the value of technology index, the more is the feasibility of technology demonstrated. The wider in technology index ranging between 70.31% and 69.22 % during the period may be attributed to the difference in the soil fertility status, weather condition and insect–pest attack on the crop. The results of the present study are in recurrence with the findings of Singh *etal*. (2012).

Economics of frontline demonstration

The inputs and outputs prices of commodities prevailed during both the year of demonstrations were taken for calculating cost of cultivation, net returns and benefit cost of ratio (table 4). The investment on production by adopting recommended trials ranged from Rs.152300 to 155600 per ha with a mean value of Rs.153950 per ha against control where the variation in cost of production was Rs.150500 to 151400 with a mean value of Rs.150950 per ha. Cultivation of sugarcane crop under recommended practices gave higher net return of Rs. 151700 and 159600 per ha due to use of botanical extract SUGRON H as compared to Rs. 135900 and 148440 per ha under farmers practice with the uses of chemical fungicide, during 2022 and 2023, respectively. The average benefit costratio of recommended practices was 1.01, varying from 1.00 to 1.03 and that of farmers practice chemical fungicides was 0.94, varying from 0.90 to 0.98. This may be due to higher yield obtained under recommended practices with botanical fungicide SUGRONH as compared to farmers practice with the chemical fungicide. Similar results have been reported earlier on sugarcane by Singh *et al*. (2012) and Gilespie *et al* (2015).

Table-2: Production yield and gap analysis of the impact of demonstrationson sugarcane crop

Year	Variety	No. of farmer	Area (ha)	Average Yield (q/ha)			increase over farmers practice (%)
				Potential	Trial (SUGRON H)	Control plots (Chemical Fungicide)	
2022-23	Co 0238	10	2.5	3200	950	895	5.79
2023-24	Co 0238	12	3	3200	985	937	4.87
Total/Average	-	22	5.5	3200	967.5	916	5.32

Table- 3: Technology gap, technology index and extension gap in sugarcane under FLDduring 2022-23 to 2023-24

Year	Variety	No. of farmer	Area (ha)	Potential	Technology gap (q/ha)	Extension Gap (q/ha)	Technological Index (%)
2022-23	Co 0238	10	2.5	3200	2250	55	70.3125
2023-24	Co 0238	12	3	3200	2215	48	69.21875
Total/ Average	-	22	5.5	3200	2232.5	51.5	69.765625

Table-4: Economic analysis of demonstrated plots and farmers practice

Year	Variety	Cost of cultivation (Rs./ha)		Gross Income (Rs./ha)		Net Return (Rs./ha)		B:C Ratio	
		Trial (SUGRO N H)	Control plots (Chemical Fungicide)	Trial (SUGRO N H)	Control plots (Chemical Fungicide)	Trial (SUGRON H)	Control plots(Chemical Fungicide)	Trial (SUGR ON H)	Control plots (Chemical Fungicide)
2022-23	Co 0238	152300.00	150500.00	304000.00	286400.00	151700.00	135900.00	1.00	0.90
2023-24	Co 0238	155600.00	151400.00	315200.00	299840.00	159600.00	148440.00	1.03	0.98
Total/ Average		153950.00	150950.00	309600.00	293120.00	155650.00	142170.00	1.01	0.94

CONCLUSIONS

The demonstration's results underline the potential for increased productivity and profitability in sugarcane cultivation when using advanced methods like bio fungicide SUGRON H. However, to fully leverage this potential, extension services, resource accessibility, and farmer education must be strengthened. Additionally, fine-tuning the technologies based on local conditions and continuously monitoring the outcomes will help further bridge the technology and extension gaps. The use of botanical extracts for plant pest management, as seen in the study with the bio fungicide SUGRON H, aligns well with the current trend of organic farming. This shift reflects farmers' growing interest in sustainable agriculture, where there is a focus on reducing reliance on synthetic chemicals and adopting natural alternatives and has increasingly gained attention from both consumers and the government over time.

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