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Performance Validation of Two Promising Sugarcane High Yielding Varieties in Semi-Commercial Production

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ABSTRACT

To compare the yield performance of Phil 2007-0243 and Phil 2009-1969 in experimental plot trials to Semi-commercial scale production in the Plant and Ratoon Cane, the two varieties were planted in experimental plots measuring 6 rows by 9 meters and Semi-commercial plots measuring 14 rows by 35 meters, which were replicated four times.

Experimental plots produced higher cane yields (TC/Ha) and sugar yields (LKg/Ha) than semi-commercial plots in both plant and ratoon canes. Phil 2009-1969 had a cane yield reduction of 12.56% and 20.62%, while Phil 2007-0243 had a cane yield reduction of 10.31% and 20.37% in plant and ratoon cane, respectively. The sugar yield for Phil 2007-0243 decreased by 30.61% for plant cane and 26.04% for ratoon cane. Moreover, the sugar yield in the plant and ratoon cane decreased by 20.03% and 37.28%, respectively, in Phil 2009-1969. Both varieties produced higher values for sucrose content (LKg/TC) in the experimental plot than in the semi-commercial plot. The sucrose content of Phil 2007-0243 of plant and ratoon cane decreased by 22.83% and 7.12%, respectively. Phil 2009-1969 also noted a decrease of 8.32% in plant cane and 20.69% in ratoon cane. On a semi-commercial scale, the ROI of Phil 2007-0243 in the plant and ratoon cane is 0.28 and 1.21, respectively, while Phil 2009-1969's ROI is 0.35 and 1.32. It is suggested that Phil 2007-0243 and Phil 2009-1969 be propagated commercially in the Pampanga Mill District due to their high yield and ROI potential.

Key word: Cane Yield (TC/Ha), Sucrose Content (Lkg/TC), Sugar Yield (LKg/TC)

INTRODUCTION

It has been observed that there exists a significant discrepancy in the sugar production per hectare between a specific variety tested in the experimental field utilizing smaller plots and the sugar production on a larger scale. This discrepancy can be attributed to the fact that smaller plots are much more manageable and easier to maintain. In order to maintain a consistent supply of high-yielding varieties, new varieties are introduced each year. These new varieties are designed to either outperform or be comparable to the existing varieties in terms of their yield performance. The inclusion of yield data from new varieties in a larger scale production, such as in a Semi-Commercial area, could potentially pique the interest of farmers to adopt these new varieties and conduct their own tests on their farms.

Seed cane production of high-yielding varieties assumes significance as alternative varieties in milling regions. Nevertheless, the ultimate selection of the dominant variety is contingent upon the decision of the planters within the district (Ocampo and Tianco et al., 1998).

Phil 2007-0243 has been suggested for additional assessment by the variety committee and for further investigation in the National Cooperative Test. The variety has successfully undergone the ecological test and demonstrates a potential yield of 148.13 TC/Ha and 2.03 LKg/TC. Additionally, it has been observed and categorized as highly resistant to downy mildew and intermediate-resistant to smut (Serrano et al., 2016). Likewise, Phil 2010-1969 is recommended to undergo further testing in order to be considered for commercial release in the National Cooperative Test. The variety has passed the ecological test based on the outcome of the gain-even-loss tally and its disease resistance (Serrano et al., 2018).

This is a confirmatory test of the performance of two promising varieties, Phil 2007-0243 and Phil 2009-1969 in Semi-Commercial Production.

OBJECTIVE:

To evaluate or verify the yield potential of two promising sugarcane varieties, Phil 2007-0243 and Phil 2009-1969 in a Semi-Commercial area in comparison with experimental plot in the plant and ratoon cane.

METHODOLOGY

Time and place of the study

The study was conducted at Luzon Agricultural Research and Extension Center (LAREC), Paguiruan, Floridablanca, Pampanga from January 2021 to January 2023.

Variety used

The study used two promising sugarcane varieties, Phil 2007-0243 and Phil 2009-1969 for comparison of yield performance of experimental plots and Semi-Commercial production.

Experimental Design and Treatment

The experiment was laid out using 14 rows X 35 meters for semi-commercial plots and 6 rows X 9 meter for experimental plots with 1.3 meters furrow distance. Five canepoints were planted per linear meter.

Cultural Practices and Maintenance

The recommended cultural practices from land preparation, planting, care and maintenance up to harvesting of sugarcane were undertaken. Weeds were controlled manually followed by plow cultivation using carabao when needed. Replanting was conducted for the missing hills. Fertilization was applied in split doses based on the soil analyses report of the laboratory.

Data Gathering

Germination data was taken 1 ½ months after planting (MAP). Tiller count was collected by manually counting the tillers of all the stools per plot, height measurements were gathered using a meter stick and recorded at 4 MAP and millable stalks were taken at 10 MAP. The Plant Cane was harvested at 12 MAP. Ten sample stalks per plot were also collected on which data on stalk length, stalk weight and stalk diameter were taken, then crushed for juice analysis. For the semi-commercial plot size, canes were harvested manually per plot and were delivered to the mill for cane crushing.

Data on cane tonnage (TC/ Ha), sugar content (Lkg/TC) and sugar yield (Lkg/Ha) were computed for the smaller plots. For the semi-commercial plots, data were collected from the mill, while other agronomic data were collected from the field.

In the establishment of the ratoon crop, the field was immediately cleared, stubble shaved and cultivated, the recommended practices in the care and management of ratoon crop were followed. Data collected was the same as in the Plant Cane.

RESULTS AND DISCUSSION

Cane tonnage in TC/Ha were decreased from experimental plots to semi commercial plots in the plant and ratoon cane (Table1). In the plant cane, Phil 2007-0243 produced 153.85 TC/Ha in the experimental plot compared to 137.98 TC/Ha in the semi-commercial plot or a decrease of 10.31 percent, while Phil 2009-1969 produced a high TC/Ha in the experimental plot of 151.87 and 132.80 TC/Ha in semi-commercial plot or a decrease in the yield of 12.56 percent.

Table 1. Cane Tonnage (TC/Ha) and percent reduction of Phil 2007-0243 and Phil 2009-1969 in the Plant and Ratoon cane

Test Varieties	Plant Cane			Ratoon Cane		
	Experimental plot	Commercial plot	Percent Decrease	Experimental plot	Semi-Commercial plot	Percent Decrease
Phil 2007-0243	153.85	137.98	10.31	118.48	94.35	20.37
Phil 2009-1969	151.87	132.80	12.56	130.13	103.30	20.62
Average	*152.86*	*135.39*	*11.44*	124.31	98.82	20.50

Note: Experimental Data were based on SRA analysis, Commercial data were based on Mill Data

Results also observed a similar trend in the ratoon cane, where both varieties Phil 2007-0243 and Phil 2009-1969 exhibited decreased cane tonnage in the semi commercial plots compared to the experimental plots. Phil 2007-0243 saw a decrease of 20.37 percent while Phil 2009-1969 was decrease by 20.62 percent. The difference in yield for the experimental plot and semi-commercial plot was due to the dissimilar method of weighing the harvested stalks. In the experimental plots, both varieties for experimental trial plots were determined in-field with specially designed weighing equipment, On the other hand, in the Semi-commercial plot are usually determined using large-scale equipment at the factory. Maximum yields obtained on experimental stations may serve as representations for yield potential. These findings emphasize the importance of standardizing data collection methods and quality control procedures when evaluating sugarcane yield potential in different production settings. Furthermore, the

study alludes to the concept of applying correction factors to account for differences in yield between experimental and commercial production, citing the example of Ramburan's work in Africa, which derived a correction factor of 0.7, equivalent to a 30% decrease in yield. This highlights the need for more accurate representations of yield potential and a better understanding of how experimental station results translate to semi-commercial production. Overall, the results underscore the need for further research to explore the underlying reasons for the observed differences and to develop strategies to improve sugarcane production in semi-commercial scale.

Table 2. Sugar content (LKg/TC) and Percent reduction of Phil 2007-0243 and Phil 2007-1969 in the Plant and Ratoon cane

Test Varieties	Plant Cane			Ratoon Cane		
	Experimental plot	Semi-Commercial plot	Percent Decrease	Experimental plot	Semi-Commercial plot	Percent Decrease
Phil 2007-0243	2.02	1.56	22.83	2.00	1.86	7.12
Phil 2009-1969	1.83	1.68	8.32	2.02	1.60	20.69
Average	1.93	1.62	15.58	2.01	1.73	13.93

Note: Experimental Data were based on SRA analysis, Commercial data were based on Mill Data

Sugar content (LKg/TC) of the test varieties responded differently from experimental plot size and semi-commercial plot sizes in the plant and ratoon cane (Table 2). Phil 2007-0243 had 2.02 Lkg/TC in experimental plots, while Phil 2009-1969 has 1.83 LKg/TC. Phil 2007-0243 had the lower LKg/TC of 1.56 in Semi-commercial plots, while Phil 2009-1969 had 1.68 LKg/TC. Comparing the data obtained for both plot sizes, it was observed that Phil 2007-0243 had decreased by 22.83 percent and Phil 2009-1969 decreased by 8.32 percent from the experimental plots when compared to Semi-commercial plots in the plant cane. Same trend was observed in the ratoon cane, Phil 2007-0243 and Phil 2009-2969 recorded a high LKg/TC in experimental plot than in the commercial plot size with percent decrease of 7.12 and 20.69 percent respectively. The difference in LKg/TC was caused by the methods and samples used for the juice analysis. Data for the experimental plot size was obtained from randomly selected clean cane samples and analyzed in the SRA soil laboratory. By securing clean stalk samples for analyses from the experimental plots, the data became more accurate compared with the samples obtained by the mill from the truckload of mixed extraneous matter including trash, leaf, and cane tops for the semi-commercial plots which had caused the sucrose content analysis result to decline. The results in LKg/TC imply that it is not guaranteed that the potential yield in experimental plots was the same as the potential yield in Semi-commercial plots.

Table 3. Sugar Yield (LKG/Ha) and percent reduction of Phil 2007-0243 and Phil 2009-1969 in the Plant and Ratoon cane

Test Varieties	Plant Cane			Ratoon Cane		
	Experimental plot	Semi-Commercial plot	Percent Decrease	Experimental plot	Semi-Commercial plot	Percent Decrease
Phil 2007-0243	310.02	215.12	30.61	237.26	175.49	26.04
Phil 2009-1969	278.66	222.84	20.03	263.51	165.27	37.28
Average	*294.34*	*218.98*	*25.32*	250.39	170.38	31.95

Note: Experimental Data were based on SRA analysis, Commercial data were based on Mill Data

Sugar yield (Lkg/Ha) data from experimental to semi-commercial plots revealed an average of 25.32 and 31.95 percent difference for both test varieties in the plant and ratoon cane (Table 3). In the plant cane, Phil 2007-0243 yielded 310.02 Lkg/Ha in the experimental plot and 215.12 Lkg/Ha in the semi-commercial plot, resulting in a 30.61 percent decrease in sugar yield. On the other hand, Phil 2009-1969 yielded 278.66 Lkg/Ha in the experimental plot and 222.84 Lkg/Ha in the semi-commercial plot, a decrease of 20.03 percent. Likewise in the ratoon cane, Phil 2007-0243 and Phil 2009-1969 both had a significant decrease in sugar yield due to high TC/Ha and high Lkg/TC in experimental plot and low TC/Ha and LKg/TC in semi-commercial plot. This is possible that the reduction in yield difference when a practice is translated from experimental field trial to semi-commercial production.

Stalk Characteristics

Table 4a. Millable Stalk of Phil 2007-0243 and Phil 2009-1969 under experimental and Semi-commercial plots in the Plant and Ratoon cane

Test Varieties	Plant Cane			Ratoon Cane		
	Experimental plot	Commercial plot	Percent Decrease	Experimental plot	Semi-Commercial plot	Percent Decrease
Phil 2007-0243	327.25	293.00	***-10.47***	360.75	349.19	***-3.21***
Phil 2009-1969	342.75	309.75	***-9.63***	390.50	379.75	***-2.75***
Average	*335.00*	*301.37*	*10.05*	*375.62*	*364.47*	*2.98*

There was a decreased in millable stalk of both test varieties in experimental plot compared to semi-commercial plots in the plant and ratoon cane. (Table 4a). In the plant cane, Phil 2009-1969 produced an average millable stalks count of 342.75 in the experimental plots and 309.75 in the semi-commercial plots size or a decrease of 9.63 percent, and Phil 2007-0243 has also decrease by 10.47 percent in the experimental plots than semi-commercial plots. In the ratoon cane, Phil 2007-0243 has a decrease of 3.21 percent while Phil 2009-1969 decrease by 2.75 percent in millable count in the experimental plots compared to semi-commercial plots size.

Table 4b. Stalk Diameter of Phil 2007-0243 and Phil 2009-1969 under experimental and Semi-commercial plots in the Plant and Ratoon cane

Test Varieties	Plant Cane			Ratoon Cane		
	Experimental plot	Commercial plot	Percent Decrease	Experimental plot	Semi-Commercial plot	Percent Decrease
Phil 2007-0243	3.26	3.05	***-6.37***	2.92	2.90	***-0.09***
Phil 2009-1969	3.44	3.10	***-9.83***	3.04	2.92	***-4.11***
Average	*3.35*	*3.075*	*8.10*	*2.98*	*2.91*	*2.10*

In stalk diameter, it was observed that there was a decreased between the experimental and semi-commercial plots for both Phil 2007-0243 and Phil 2009-1969 sugarcane varieties across plant and ratoon cane stages (Table 4b). Phil 2009-1969 exhibited a bigger mean stalk diameter in the experimental plots, registering 3.44 cm and 3.04 cm in plant and ratoon cane respectively, while in the semi-commercial plots, the diameter decreased to 3.10 cm and 2.92 cm, corresponding to a reduction of 9.83% and 4.11% in the plant and ratoon cane stages respectively. While Phil 2007-0243 showed a mean stalk diameter of 3.26 cm and 2.92 cm in experimental plots, and in semi-commercial plots, the values changed to 3.05 cm and 2.90 cm, showing a decrease of 6.37% and 0.09% in the plant and ratoon cane.

Table 4c. Stalk Length of Phil 2007-0243 and Phil 2009-1969 under experimental and Semi-commercial plots in the Plant and Ratoon Cane

Test Varieties	Plant Cane			Ratoon Cane		
	Experimental plot	Commercial plot	Percent Decrease	Experimental plot	Semi-Commercial plot	Percent Decrease
Phil 2007-0243	285.03	274.13	***-3.82***	252.15	231.63	***-8.14***
Phil 2009-1969	270.63	266.15	***-1.65***	241.30	234.15	***-2.96***
Average	*277.83*	*270.14*	*2.735*	*246.73*	*232.89*	*5.55*

The stalk length of Phil 2009-0243 and Phil 2009-1969 was longer in the experimental plots than In Semi-commercial plots size in the plant and ratoon cane (Table 4c). In the plant cane, Phil 2007-0243 recorded a longer stalk of 285.03 in the experimental plots and 274.13 in semi-commercial plots size with percent decreased of 3.82 also Phil 2009-1969 had a longer stalk in experimental plots than commercial plot size. In the ratoon cane, a decrease was also observed in experimental plots when compared to semi-commercial plots with Phil 2007-0243 decrease by 8.14 percent and Phil 2009-1969 with 2.96 percent.

Table 5: Economic Analysis

Table 5: Cost of Production, Net Income and Return of Investment (ROI), in peso, of Phil 2007-0243 and Phil 2009-1969 in the Plant and ratoon Cane

Varieties	Plant Cane								
	Production Cost			Net Income			ROI		
	Experimental plots ('000)	Semi-Commercial plots ('000)	Difference ('000)	Experimental plots ('000)	Semi-Commercial plots ('000)	Difference ('000)	Experimental plots	Semi-Commercial plots	Difference
Phil 2007-0243	242.98	228.20	14.77	168.29	64.33	103.96	0.69	0.28	0.41
Phil 2009-1969	238.46	223.03	15.44	132.81	78848	54.34	0.56	0.35	0.21

Table 5a: Cost of Production, Net Income and Return of Investment (ROI), in peso, of Phil 2007-0243 and Phil 2009-1969

Varieties	Ratoon Cane								
	Production Cost			Net Income			ROI		
	Experimental plots (,000)	Semi-Commercial plots ('000)	Difference ('000)	Experimental plots ('000)	Semi-Commercial plots ('000)	Difference ('000)	Experimental plots	Semi-Commercial plots	Difference
Phil 2007-0243	196,20	166.02	30.18	264.73	201.02	63.71	1.35	1.21	0.14
Phil 2009-1969	207.87	174.98	32.88	303.10	230.62	72.47	1.46	1.32	0.14

The test varieties for experimental plots and semi-commercial plots differ in the Net Income and ROI (Table 5 and 5a). In the plant cane, Phil 2007-0243 had a difference in net income and ROI of Php103,961.87 and 0.41 respectively, while Phil 2009-1969 had a difference in net income and ROI of Php 54,337.97 and 0.21 respectively, In the ratoon cane, Phil 2007-0243 had an ROI of 1.35 and Phil 2009-1969 had an ROI of 1.46 in the experimental plot, while in the semi-commercial plot size, Phil 2007-0243 had an ROI of 1.21 and Phil 2009-1969 with ROI of 1.32, both test varieties had a difference in ROI of 0.14. The high difference in Net income and ROI of Phil 2007-0243 was due to a high decrease in LKg/TC (Table 2) that cause also in a high decrease in sugar yield. This result of the comparison between the experimental and semi-commercial plots for both varieties showed that there are factors that planters had no control from harvesting of canes up to the milling such as the possible delay of taking juice samples for analysis, transport, mixed of materials in the truckload compared with the results from the experimental plots where clean stalk samples were immediately processed with specified equipment.

CONCLUSION

Two promising High Yielding Varieties, Phil 2007-0243 and Phil 2009-1969 were planted In the experimental plots, which measured 6 rows by 9 meters, both varieties produced higher cane yields (TC/Ha) and sugar yields (Lkg/Ha) compared to the semi-commercial plots, which measured 14 rows by 35 meters.

The study revealed significant decreases in cane tonnage (TC/Ha), sugar rendement (LKg/TC), and sugar yield (LKg/Ha) when transitioning from experimental to semi-commercial plots for both sugarcane varieties, Phil 2007-0243 and Phil 2009-1969. In the plant cane, Phil 2007-0243 and Phil 2009-1969 experienced reductions in cane tonnage by approximately 10.31% and 12.56%, respectively, and similar trends were observed in the ratoon cane. Sugar content exhibited even more pronounced differences, with Phil 2007-0243 and Phil 2009-1969 decreasing by 22.83% and 8.32% respectively in the plant cane. Sugar yield also decreased significantly with Phil 2007-0243 and Phil 2009-1969 yielding 30.61% and 20.03% less sugar in the semi-commercial plots compared to experimental plots. On a semi-commercial scale, the return on investment (ROI) for Phil 2007-0243 was 0.28 in plant cane and 1.21 in ratoon cane, while Phil 2009-1969 had an ROI of 0.35 in plant cane and 1.32 in ratoon cane. These variations were primarily attributed to differences in weighing methods, juice analysis and sample quality, highlighting the need for standardized procedures and quality control in sugarcane production.

Based on these findings, it is suggested that both Phil 2007-0243 and Phil 2009-1969 be commercially propagated in the Pampanga Mill District due to their high yield and ROI potential.

A similar study can be tested on other varieties in different soil and environmental conditions.

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THE SUGAR LINK; Vol.9-011, April-June 2011,Performance of SRA New HYV's in Visayas Mill District, Issue No. 28 pp 01.

Appendix Table 1. Monthly rainfall precipitation

Month	2021	2022	2023
January	64.3	8.7	62.7
February	42.2	5.0	
March	9.8	22.2	
April	5.4	36.9	
May	104.6	138.3	
June	110.8	196.2	
July	773.7	175.6	
August	436.1	427.9	
September	384.4	275.2	
October	185.8	261.4	
November	36.5	33.3	
December	104.9	3.4	
Total	2,258.5	1,584.1	62.7

The monthly rainfall precipitation was shown in Appendix table 1, Based on the data collected there is sufficient rainfall throughout the duration of the study. Handbook on sugarcane growing stated that annually sugarcane growing need 53 inches or 1,346.2 mm of moisture for good growth or to attain the maximum yield.

Appendix Table 2. Soil analysis

pH	5.65
OM (%)	0.94
P (ppm)	7
K (ppm)	170
Ca (ppm)	1620
Kg N/Ha	185
Kg P2O2/Ha	155
Kg K2O/Ha	0
Lime ton/Ha	0.9