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PRELIMINARY YIELD TEST OF PHIL 2017 SERIES VARIETIES

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Abstract

Twenty-eight test clones of the Phil 2017 series varieties were evaluated for their agronomic and yield performance in comparison with two check varieties Phil 80-13, the national check variety and Phil 75-44, the local check . The study was laid out in randomized complete block design at the Luzon Agricultural Research and Extension Center in Floridablanca, Pampanga. Among the clones evaluated Phil 2017-0505, Phil 2017-0849, Phil 2017-0873, Phil 2017-1089, Phil 2017-1321, Phil 2017-1331, Phil 2017-1557, Phil 2017-1743, and Phil 2017-1965 produced significantly higher sugar yield than both check varieties with an average of 359.53 Lkg/Ha indicating favorable genetic response to the agro-climatic conditions at LAREC. Phil 2017-0981 also produced higher sugar yield than Phil 75-44 and comparable with Phil 80-13. The clones were also resistant to smut and downy mildew and were non-flowering to sparse flowerers at the time of the study. These clones may have the potential to perform well in other agro-climatic conditions.

INTRODUCTION

Development of high-yielding varieties is a continuing process undertaken in all crop breeding programs. This is because performance of high-yielding varieties decline over time due to various factors such as adverse soil and climatic conditions, cultural practices, biotic stresses and evolution among others (Galon, 2013; Garside, 2005). Breeding is a multi-stage process that could take years before a desirable variety could be produced. This is especially true for some crops like sugarcane which takes an average of 12 months before its yield and other agronomic characteristics could be determined.

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In sugarcane breeding clones undergo a series of tests or stages from Pollination and Seedling Care to the Ecological or National Cooperative Test to find out its potential for release (SRA, 1991). The Preliminary Yield Test is the first replicated yield trial routinely carried out in the research station to determine the yield of clones selected from the Row Test of a specific breeding season. This study investigated the yield potential of selected clones of Phil 2017 series varieties in comparison with check varieties Phil 8013 and Phil 7544 under natural field conditions at the Luzon Agricultural Research and Extension Ceter(LAREC) in Floridablanca, Pampanga. The test also observed the resistance of the clones to insect pests and diseases as well as its flowering ability.

MATERIALS AND METHODS

Time and place of study

The study was conducted at the Luzon Agricultural Research and Extension Center (LAREC), Floridablanca, Pampanga from March 2022 to June 2023 under sandy soil conditions.

Experimental design and treatments

The study was laid out in randomized complete block design replicated three times in a 6 row x 6 meters-long plot sizes area. The treatments were 28 clones from the Phil 2017 Row Test series selected by the La Granja Agricultural Research and Extension Center (LGAREC) to undergo the Preliminary Yield Test and two check varieties Phil 75-44, the local check variety and Phil 80-13, the national check variety. Three-eye healthy canepoints were used as planting materials. Planting density was four canepoints per linear meter.

Cultural operations and maintenance

Soil sample was taken before land preparation and analyzed at the LAREC soil laboratory as basis for fertilization. Experimental area was prepared with a series of plowing and harrowing to pulverize the soil. After planting, replanting was done at one and a half months to maintain uniform population among the test entries. Ridge busting, alternate off-barring and hilling up were undertaken to cultivate the soil for the proper growth and development of the crop. Fertilizers were applied at one and a half months and before closing of the canopy based on the fertilizer recommendation report. Weeding and irrigation were also undertaken whenever necessary. Harvesting was done at 12 months after planting.

Data Gathered and Statistical Analysis

1. Germination at 1 ½ months after planting (MAP)
2. Tiller count 4 MAP
3. Plant height at 4 MAP
4. Number of millable stalks/plot at 8 MAP
5. Pest and Diseases at 4 and 6 MAP
6. Plot weight at harvest
7. Stalk length at harvest
8. Stalk diameter at harvest
9. Computed cane yield or tonnage (TC/Ha) from plot weight
10. Computed sugar recovery or sugar rendement (LK/g/TC) in number of 50 Kg bags of raw sugar per ton cane based on laboratory analysis of extracted juice from 10 cane samples per plot
11. Computed sugar yield per hectare (LKg/Ha) in number of 50 Kg bags of raw sugar based on TC/Ha and LKg/TC
12. Flowering incidence at emergence

The data was analyzed using the Statistical Tool for Agricultural Research (STAR 2.0.1) and the planned pair comparison of means were done at 5% level of significance using the LSD test.

Test clones that significantly outyielded or comparable to both of the check varieties in sugar yield (Lkg/Ha), rated resistant to smut (5.6-7.5% infection) and downy mildew(9.0-12.9% infection) and very sparse flowering(1.0-20%) were recommended to undergo the Ecological Test or the National Cooperative Test.

Result and Discussion

A. Yield Performance

The potential of a certain variety can be determined by its tonnage, sugar rendement and sugar yield. Significant differences were observed between most of the paired comparison between test clones and the check varieties as shown in Table 1.

Tonnage (TC/Ha)

Tonnage or cane yield is a function of the millable stalk population and its weight. Therefore, it is desirable to have a variety that can produce more millable and heavier stalks to ensure a good cane yield.

Nineteen test clones produced significantly higher tonnage against the two check varieties. Among them Phil 2017-1557 produced the highest mean tonnage (258.84 TC/Ha) that is 71.07% and 157.22 % higher than Phil 80-13 (151.31 TC/Ha) and Phil 75-44(100.63 TC/Ha), respectively. Cane yield of these clones ranged from 175.34 to 258.84 TC/Ha. Three other test clones Phil 2017-0559, Phil 2017-1065 and Phil 2017-1875 produced yields more than Phil 75-44 and comparable with Phil 80-13 while six other clones had yields that were either higher or lower than both check varieties. High

tonnage clones , in general, had higher number of millable stalks and heavier weight compared with the check varieties.

Sugar Rendement (Lkg/TC)

Sugar rendement is the sugar produced expressed as a percentage by weight of the cane crushed. The ability of a variety to produce high sucrose is dictated by its genetic trait as influenced by existing environment at the time of maturity.

In this study, it was noted that none of the test clones produced significantly higher yield than both or either of the check varieties. Four clones, Phil 2017-095, Phil 2017-1665, Phil 2017- 19645, and Phil 2017-2065 were comparable with both check varieties producing within the range of 1.84 - 1.87 Lkg/TC compared to 1.83 and 1.78 LKg/TC of Phil 80-13 and Phil 75-44, respectively. Eight were comparable with Phil 75-44 but produced lower than Phil 8013 while the remaining 16 clones gave significantly lower yields than both check varieties (1.40-1.76 Lkg/TC).

Sugar Yield (Lkg/Ha.)

Sugar yield is a function of cane tonnage and sugar rendement and translates into the number of 50-kilogram bags of raw sugar that can be derived from a hectare of planted sugarcane variety. As such sugar yield of the test clones were influenced by these two parameters.

Significant differences were observed between each comparison with at least one of the check varieties. Ten clones produced higher yields than both check varieties, namely, Phil 2017- 0505, Phil 2017-0849, Phil 2017-0873, Phil 2017-1089, Phil 2017-1321, Phil 2017-1331, Phil 2017-1441, Phil 2017- 1557, Phil 2017-1743, and Phil 2017-1965. Among them, Phil 2017-0849 had the highest mean sugar yield (393.73 LKg/Ha) that is 42.44% and 118.82% higher than Phil 80-13 (276.41Lkg/Ha) and Phil 75-44 (179.93Lkg/Ha), respectively. Average yield of the clones was 359.40 LKg/Ha. Ten clones

also had higher yields than Phil 75-44 and comparable with Phil 80-13. Observed yields ranged from 279.28 to 330.24 LKg/Ha with mean yield of 309.69 LKg/Ha.

It was observed that from the 19 test clones which produced higher cane yield than both check varieties only 10 had more potential to give the desirable sugar yield compared with the two check varieties. This is due to their much higher cane yield which negated their low sugar rendement. The results suggest the genetic yield potential of the tested clones under the agro-climatic conditions at LAREC in comparison with the local and national check varieties.

Table 1. Yield performance of Phil 2017 series

	Entries	TC/Ha	Lkg/TC	Lkg/Ha
	Phil 8013 a	151.31	1.83	276.41
	Phil 75-44 b	100.63	1.78	179.93
1	Phil 2017- 0505	196.60 +ab	1.76 -ab	346.40 +ab
2	Phil 2017- 0539	181.07 +ab	1.72 -ab	310.87 +b
3	Phil 2017- 0559	157.73 +b	1.78 -a	280.50 +b
4	Phil 2017- 0649	201.41 +ab	1.60 -ab	322.53 +b
5	Phil 2017- 0849	240.07 +ab	1.64 -ab	393.73 +ab
6	Phil 2017- 0873	197.36 +ab	1.79 -a	352.97 +ab
7	Phil 2017- 0951	127.68 -a+b	1.85 ns	235.28 -a+b
8	Phil 2017- 0981	186.32 +ab	1.78 -a	330.24 +b
9	Phil 2017- 1033	194.48 +ab	1.49 -ab	287.92 +b
10	Phil 2017- 1065	158.31 +b	1.53 -ab	242.45 -a+b
11	Phil 2017- 1089	197.25 +ab	1.82 -a	358.54 +ab
12	Phil 2017- 1107	194.29 +ab	1.67 -ab	325.55 +b
13	Phil 2017- 1179	130.80 -a+b	1.44 -ab	187.96 -a
14	Phil 2017- 1321	215.78 +ab	1.63 -ab	351.37 +ab
15	Phil 2017- 1331	188.56 +ab	1.80 -a	338.10 +ab
16	Phil 2017- 1397	175.34 +ab	1.77 -ab	307.83 +b
17	Phil 2017- 1441	242.23 +ab	1.47 -ab	358.28 +ab
18	Phil 2017- 1557	258.84 +ab	1.40 -ab	360.54 +ab
19	Phil 2017- 1665	123.96 -a+b	1.84 ns	226.84 -a
20	Phil 2017- 1743	199.41 +ab	1.78 -a	354.98 +ab
21	Phil 2017- 1875	156.31 +b	1.67 -ab	262.92 -a+b
22	Phil 2017- 1921	181.44 +ab	1.55 -ab	279.28 +b
23	Phil 2017- 1965	203.02 +ab	1.87 ns	379.13 +ab
24	Phil 2017- 2027	135.08 -a+b	1.61 -ab	218.43 -a
25	Phil 2017- 2031	178.75 +ab	1.82 -a	325.80 +b
26	Phil 2017- 2065	143.55 -a+b	1.84 ns	264.82 -a+b
27	Phil 2017- 2093	132.82 -a+b	1.79 -a	237.80 -a+b
28	Phil 2017- 2145	205.56 +ab	1.59 -ab	326.34 +b
	CV(%)	5.05	12.22	12.66

+ab - significantly higher than both check varieties
-ab - significantly lower than both check varieties
-a+b - significantly lower than Phil 80-13 but higher than Phil 75-44
-a - significantly lower than Phil 80-13 but comparable to Phil 75-44
+b - significantly higher than Phil 75-44 but comparable to Phil 80-13
ns - comparable to both check varieties

B. Agronomic Performance

Agronomic traits are important considerations in the selection of high yielding varieties since these traits influence yield outcomes. Agronomic performance of a variety is determined by genetic traits and how it reacts with the environment in the location where it is grown. Thus, varieties may be expected to perform differently even under similar conditions.

Presented in Table 2 are the agronomic performance of the different clones with respect to its stalk attributes, reaction to diseases and flowering ability.

Tiller Count

Tillers are the secondary shoots that emerge from the primary cane shoot. They are the primary sink for products derived from photosynthesis. A variety with an early flush of tillers is desirable because it results in more or less uniform plants and minimizes tiller mortality. Surviving tillers become millable stalks which contribute greatly to cane tonnage.

Among the test clones Phil 2017-0951, Phil 2017-1033, Phil 2017-1321 and Phil 2017-2031 produced significantly higher number of tillers with an average of 291 tillers per plot compared to 226 tillers per plot for both check varieties suggesting favorable genetic response under the existing environmental conditions. Eight other clones were comparable to Phil 80-13 and Phil 75-44 while all other test clones had significantly lower number than one of both check varieties which could mean unsuitability of the clones to the local conditions. Tiller counts ranged from 165-289 per plot

Millable Stalk

Millable stalks are the tillers that survived after the tillering stage and are expected to be harvested and milled. This stalk attribute is one of two factors that generally determines the cane tonnage yield of a variety.

Three test clones namely Phil 2017-1321, Phil 2017-1557, and Phil 2017-1965 produced significantly higher number of millable canes with an average of 219 millable stalks per plot compared to 151 millable stalks per plot for both check varieties indicating better tiller survival rate. Phil 2017-0649 and Phil 2017-2031 produced higher number than Phil 75-44 while all others were either comparable to both check varieties or significantly lower than one or both check varieties. Millable stalk counts ranged from 113-227.

Plant Height

Plant growth after the tillering stage is affected by genetic traits as well as other factors such as climate and soil conditions. Growth is faster under high temperatures especially at night with sufficient soil moisture and chlorophyll.

Phil 80-13 in general, prevailed over all test entries in terms of stalk growth. Against Phil 75-44, five clones Phil 2017-0559, Phil 2017-1321, Phil 2017-1331, Phil 2017-1743, and Phil 2017-2145 were able to gain higher height producing an average of 182.4 cm compared to 156 cm of Phil 75-44. These five clones were also comparable with Phil 80-13. All other clones produced significantly lower height than one or both check varieties.

Stalk Length

Among the test clones only Phil 2017-1441 with 280 cms length had significantly longer stalks than both check varieties. Nineteen were comparable to both checks while the rest were shorter than one or both check varieties.

Stalk Diameter

None of the test clones were thicker than Phil 80-13 and Phil 75-44. Phil 2017-0505 and Phil 2017-1665 both had thicker stalks with an average of 3.31 cm higher than Phil 80-13 but comparable only with Phil 75-44. All other test clones were either lower/comparable with Phil 75-44 and higher /comparable with Phil 80-13 or conversely. Stalk diameter ranged from 2.86-3.34 cm among the test clones.

Stalk Weight

Nine test clones were significantly heavier than both check varieties. Among these clones Phil 2017-0505 was the highest at 2.33 kgs per stalk while Phil 2017-1065 was the lightest at 1.75 kgs. Average weight of these clones is 1.84 kgs compared to the average weight of both check varieties at 1.53 kgs per stalk. Six other clones were heavier than Phil 75-44 but comparable with Phil 80-13. All other clones in general were lighter than Phil 80-13 but comparable with Phil 75-44.

C. Disease Resistance

Screening of the clones for smut resistance during the plant cane showed that seven clones were very highly resistant (1.0-2.5% infection), namely, Phil 2017- 0559, Phil 2017-0849, Phil 2017-1033, Phil 2017-1065, Phil 2017-1179, Phil 2017-1331, and Phil 2017-1875 while 11 were highly resistant((2.6-5.5%) and two were resistant(5.6-7.5%). All other clones were intermediate resistant to susceptible (7.6-18.5%). On downy mildew resistance visual observation shows that all test clones were very highly resistant to highly resistant to infection with a rating of 0-8.0 %.

D. Flowering Incidence

Flowering is a genetic trait highly influenced by environmental conditions such as temperature, daylength, soil moisture and nitrogen. It also decreases yield when crops are harvested late.

Flowering incidence among test clones ranged from 0 to 32.0 percent. Nine clones were observed to be non-flowering at the time of the study. These are Phil 2017- 0505, Phil 2017-0559, Phil 2017-0849, Phil 2017-0981, Phil 2017-1331, Phil 2017-1665, Phil 2017-1875, Phil 2017-2093, and Phil 2017- 2145. Sixteen were very sparse flowerer with a range of 1-20% , one sparse flowerer (21-30%) and one moderate(31-50%). These clones should be observed for several years to assess their flowering ability at varying climatic conditions.

Table2. Stalk Attributes and Disease Resistance of Phil 2017 series varieties

	ENTRIES	Tillers per plot	Millable stalk per plot	Height (cm)	Length (cm)	Diameter (cm)	Weight (kg/stalk)	Smut (%) - PC	Downy Mildew (%)	Flowering %
	Phil 80-13	217	164	177	239	2.93	1.61			
	Phil 75-44	234	138	156	235	3.27	1.45			2.11
1	Phil 2017- 0505	206-ab	119-ab	134-ab	252ns	3.34+a	2.33+ab	9.3	0	0
2	Phil 2017- 0539	188-ab	175ns	155-ab	239ns	3.11-b	1.55-a	3.8	0	3.09
3	Phil 2017- 0559	202-ab	157-a	185+b	253ns	2.94-b	1.48-a	2.5	0	0
4	Phil 2017- 0649	236ns	203+b	157-a	236-a	2.84-ab	1.53-a	7.3	1.0	3.54
5	Phil 2017- 0849	217-b	171ns	151-ab	246ns	2.99-b	1.81+ab	1.2	0	0
6	Phil 2017- 0873	213-ab	156-a	168-a	260ns	3.00-b	1.76+ab	4.8	0	1.28
7	Phil 2017- 0951	282+ab	105-ab	112-ab	234-ab	2.97-b	1.56-a	18.5	0	9.30
8	Phil 2017- 0981	238ns	129-ab	147-ab	263ns	3.09-b	1.78+ab	8.5	0	0
9	Phil 2017- 1033	289+ab	166ns	142-ab	247ns	3.22+a-b	1.64+b	1.4	0	1.52
10	Phil 2017- 1065	165-ab	144-a	148-ab	250ns	3.08-b	1.75+ab	1.2	2.0	2.35
11	Phil 2017- 1089	252ns	162-a	150-ab	253ns	3.19+a-b	1.59+b	4.1	1.0	19.44
12	Phil 2017- 1107	179-ab	171ns	146-ab	221-ab	2.86-b	1.37-ab	9.9	0	1.36
13	Phil 2017- 1179	208-ab	120-ab	152-ab	256ns	3.14-b	1.72+b	0	0	4.17
14	Phil 2017- 1321	313+ab	227+ab	177+b	240ns	3.01-b	1.46-a	2.8	0	17.95
15	Phil 2017- 1331	255ns	155-a	180+b	236-a	3.17+a-b	1.68+b	2.1	2.0	0
16	Phil 2017- 1397	249ns	135-ab	155-ab	229-ab	3.15+a-b	1.67+b	6.2	8.0	29.56
17	Phil 2017- 1441	230-b	175ns	141-ab	280+ab	2.97-b	1.81+ab	5.4	0	32.00
18	Phil 2017- 1557	227-b	212+ab	142-ab	241ns	3.20+a-b	1.58-a	9.1	6.0	7.43
19	Phil 2017- 1665	233-b	129-ab	176-a+b	244ns	3.27+a	1.75+ab	11.8	0	0
20	Phil 2017- 1743	216-ab	162-a	179+b	254ns	3.05-b	1.85+ab	3	0	2.82
21	Phil 2017- 1875	250ns	178ns	169-a	255ns	3.01-b	1.58-a	1.6	0	0
22	Phil 2017- 1921	202-ab	162-a	172-a	239ns	3.19+a-b	1.76+ab	11.5	1.0	24.71
23	Phil 2017- 1965	257ns	217+ab	159-a	247ns	2.91-ab	1.57-a	2.9	0	2.49
24	Phil 2017- 2027	223-b	125-ab	167-a	225-ab	2.99-b	1.56-a	2.7	0	24.82
25	Phil 2017- 2031	280+ab	187+b	146-ab	222-ab	2.99-b	1.33-ab	3.9	0	0.79
26	Phil 2017- 2065	236ns	157-a	155-ab	243ns	2.95-b	1.48-a	4.8	0	1.00
27	Phil 2017- 2093	219-b	113-ab	156-a	233-ab	3.20+a-b	1.71+b	2.6	2.0	0
28	Phil 2017- 2145	207-ab	169ns	191+b	245ns	3.18+a-b	1.77+ab	10.8	0	0
	CV(%)	13.51	20.03	8.09	9.70	4.96	5.78			

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-a+b - significantly lower than Phil 80-13 but higher than Phil 75-44
-a - significantly lower than Phil 80-13 but comparable to Phil 75-44
+b - significantly higher than Phil 75-44 but comparable to Phil 80-13
ns - comparable to both check varieties

Conclusion and Recommendation

Among the clones evaluated Phil 2017-0505, Phil 2017-0849, Phil 2017-0873, Phil 2017-1089, Phil 2017-1321, Phil 2017-1331, Phil 2017-1557, Phil 2017-1743, and Phil 2017-1965 significantly produced higher sugar yield than both check varieties. They were rated very highly resistant to intermediate resistant to smut in the plant cane, very highly resistant to resistant to downy by natural occurrence and non-flowering to very sparse flowering. Phil 2017-0981 is comparable to Phil 80-13 but higher in sugar yield than Phil 75-44 and also passes the criteria for diseases rating and flowering incidence.

These clones are recommended to undergo further testing in the Ecological Test.

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