FIBER RECOVERY AND QUALITY OF TEN ABACA VARIETIES

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ABSTRACT

The 10 abaca varieties significantly differed in almost all of the parameters considered. Lawaan x Tangongon had the heaviest weight of fresh stalk and tuxies in the outer and middle groups of leafsheaths, produced the highest weight of dry fiber recovered, and ranked second in terms of tensile strength per group of leafsheaths. Pacol x CES 2 ranked second in terms of weight of fresh stalks, produced the heaviest weight of tuxies from the inner group, ranked second heaviest in the outer and middle groups, but produced the lowest fiber recovery and percentage fiber stretch in the 3 groups of leafsheaths. Furthermore, Pacol x CES 2 produced the lowest tensile strength from the outer and inner groups and ranked second to the lowest in the middle group. Linawaan produced the highest fiber recovery while Ginabaki and Bulao Luno produced the highest tensile strength and percentage fiber stretch in all groups of leafsheaths, respectively. With respect to fiber quality, Bulao Luno, Lawaan x Tangongon, Linawaan, Casilihon, and Amokid had better quality of fiber than the rest of the varieties tested.

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KEY WORDS: Abaca. Fiber recovery. Fiber quality. Group of leafsheath. Tuxy.

INTRODUCTION

Among the factors affecting fiber recovery and quality in abaca are (a) undesirable practices such as harvesting of immature and over-mature fibers, improper storage and processing, improper adjustment/ irregular serration of the blade of the stripping knife, delayed tuxying and stripping, (b) other operations employed during harvesting, fiber extraction and subsequent handling of fibers, and (c) the selection of desirable variety to be grown under local conditions.

Of the different varieties and hybrids of abaca that have been developed, some are being recommended for commercial planting

while the others which show potentials for the fiber industry are undergoing field trials and adaptability tests. This study was conducted to determine the fiber yield and quality of 10 abaca varieties introduced in ViSCA.

MATERIALS AND METHODS

Varieties Used.— The 10 abaca varieties tested for fiber yield and quality were Pacol x CES 2, Sinampago, Bulao Luno, Binagakay, Lawaan x Tangongon, Linawaan, Del Monte Pula, Amokid, Casilihon, and Ginabaki.

Experimental Design.— A simple completely randomized design was used with 3 Replications. Ten abaca stalks were utilized per treatment with 100 stalks per replication. The experimental plants used were obtained at the Abaca Gene Bank of the College. Samples were taken at random from plants that were in the flagleaf stage or those that had already developed mature stalks.

Harvesting.— The plants were not harvested at the same time. Harvesting started when the mother plant had reached the flagleaf stage (or maturity period). After the stalks were cut, the remaining leaves at the top were removed with a knife or bolo prior to the preparation of strips or tuxies.

Weighing.— Harvested leafless abaca stalks were weighed immediately. To determine fiber recovery based on the weight of tuxies, tuxies from the different treatments were weighed prior to stripping.

Tuxying.— Shortly after weighing, abaca stalks were tuxied using a tuxying knife. Tuxied were grouped as follows:

Group A - the outer sheaths composed of colored sheaths;
Group B - the middle sheaths composed of whitish sheaths with drying petiole;
Group C - the inner sheaths composed of the rest of the sheaths.

This grouping was done because leafsheaths of abaca stalks vary in their physical characteristics, thus providing different fiber grades.

Stripping.— Stripping of tuxies followed right after tuxying, using a spindle stripping machine. The extracted fibers from the different groups of leafsheaths were separated per variety and were labelled accordingly.

Drying.— Fibers were sundried immediately after extraction by hanging them on horizontal bamboo poles or wires during sunny days and air-dried under the shed during rainy days. This was done to remove the moisture in the extracted fiber. This procedure prevented the possible attack of molds and weevils, thus obtaining a better fiber quality.

Fiber Quality.— Fibers were graded

based on the standards set by the Bureau of Fiber Development and Inspection Service, Adm. Order No. 2-A (Series of 1974) with respect to color, cleanness, texture, fineness, and length of fiber.

Determining the Tensile Strength and Fiber Stretch.— The 20-cm long samples (10 fiber strands per group) were weighed and the fibers were tested using the Shimadzu Tensile Tester Machine which measured the breaking load. The tensile strength was computed using the following formula of Botkin *et al.* (1943).

$$\text{Tensile Strength (kg/g-m)} = \frac{\text{breaking load of the fiber (kg)}}{\text{wt. of fiber (g)/length of fiber (m)}}$$

RESULTS AND DISCUSSION

Weight (kg) of Fresh Stalk.

Results showed significant differences among varieties (Table 1). Lawaan x Tangongon had the heaviest weight of fresh stalks, followed by Pacol x CES 2, Casilihon, and Ginabaki. Sinampago had the lowest weight. Bulao Luno, Linawaan, Del Monte Pula, and Amokid had weights comparable to Sinampago.

The differences in weight of fresh stalk among varieties may be attributed to the varietal differences of abaca plants. Some varieties produced bigger stalks while others developed smaller ones. However, size of stalks may not be used as a

Table 1. Weight of fresh stalk, fiber recovered, and percentage fiber recovery of 10 abaca varieties.

Variety	Weight of Fresh Stalk (kg)	Weight of Fiber Recovered/Stalk (g)	Percentage Fiber Recovery
Pacol x CES 2	**21.75 ab**	**81.34 d**	**0.37 f**
Sinampago	**5.97 e**	**79.91 d**	**1.34 b**
Bulao Luno	**10.16 de**	**111.11 cd**	**1.09 d**
Binagakay	**13.95 cd**	**197.07 b**	**1.41 b**
Lawaan x Tangongon	**23.74 a**	**307.91 a**	**1.29 bc**
Linawaan	**9.45 de**	**160.03 bc**	**1.69 a**
Del Monte Pula	**10.73 de**	**154.94 bc**	**1.44 b**
Amokid	**10.14 de**	**117.06 cd**	**1.15 cd**
Casilihon	**19.95 ab**	**160.92 bc**	**0.81 e**
Ginabaki	**16.83 bc**	**153.82 bc**	**0.91 e**
C.V. (%)	**18.43**	**19.62**	**8.31**

Treatment means having a common letter are not significantly different at 5% level using DMRT.

sole basis for selecting varieties for commercial planting because some varieties have smaller stalks and yet yield more fibers than the bigger ones.

Weight (g) of Dry Fiber Recovered per Stalk.

Lawaan x Tangongon was significantly superior to all the other varieties (Table 1). Binagakay did not differ significantly from Linawaan, Del Monte Pula, Casilihon, and Ginabaki, but proved to be significantly better than Amokid, Bulao Luno, Sinampago, and Pacol x CES 2. The latter two varieties had weights comparable to Bulao Luno and Amokid.

Being the highest yielder among the 10 varieties, Lawaan x Tangongon had been marked as a potential variety for commercial planting. This variety had been singled out by Garcia (1978) as the best among 5 abaca varieties he studied since it produced an average of 813.9 g of dry fiber per stalk.

On the other hand, Baliguas (1954) observed that Binagakay produced 48.2 g of dry fiber per stalk, the highest among 7 abaca varieties he studied. Probably, the growth of his experimental plants, specifically Binagakay, was not as exuberant as the growth of the same variety of plants used in this study. This differential growth observed in the same variety of plants planted in different locations could be due to differences in environmental conditions.

It may be noted that Pacol x CES 2 hybrid ranked second to the lowest with respect to the weight of dried fibers recovered per stalk although it followed Lawaan x Tangongon in terms of weight of fresh stalk (Table 1). For cordage purposes, this is an undesirable morphological characteristic although it may be highly desirable if an abaca plant is grown as raw material for pulp and paper production. These results underscore the importance of judicious selection of abaca varieties to be grown.

Percentage Fiber Recovery.

Statistical analysis showed significant variations in percentage fiber recovery among varieties. Linawaan produced the highest percentage fiber recovery, followed by Del Monte Pula, Binagakay, and Sinampago. Pacol x CES 2 had the lowest fiber recovery (Table 1).

However, emphasis must be made that not one of the parameters mentioned above can serve as an accurate index for fiber yield/unit area. Nevertheless, they can be useful guides in the selection of variety to be grown. Ideally, a desirable variety is one which produces more stalks that are big and long and gives high percentage fiber recovery and possesses better fiber qualities.

Weight (kg) of Tuxies from the Outer Group.

Weight of tuxies from the outer group of leafsheaths ranged from 0.282 (Sinampago) to 0.862 kg

Table 2. Average weight of tuxies, fiber stretch, and tensile strength per group of leafsheaths (outer, middle, inner) of 10 abaca varieties.

Groups/Variety		Weight of Tuxies (kg)	Fiber Stretch (%)	Tensile Strength (kg/g-m)
O	Pacol x CES 2	0.755 a	0.63 c	9.76 e
	Sinampago	0.282 d	0.85 b	15.64 bcd
U	Bulao Luno	0.328 d	1.33 a	16.95 abc
	Binagakay	0.708 a	0.80 bc	13.11 d
T	Lawaan x Tangongon	0.862 a	0.80 bc	17.94 ab
	Linawaan	0.328 d	0.84 b	14.01 d
E	Del Monte Pula	0.337 cd	0.85 b	15.19 cd
	Amokid	0.465 bc	0.84 b	15.34 bcd
R	Casilihon	0.750 a	0.83 b	15.61 bcd
	Ginabaki	0.487 b	0.81 b	19.43 a
	C.V. (%)	13.64	12.07	8.98
M	Pacol x CES 2	0.922 a	0.74 b	10.87 c
	Sinampago	0.198 e	0.83 b	15.44 b
I	Bulao Luno	0.427 cd	1.05 a	15.78 b
	Binagakay	0.777 b	0.78 b	10.48 c
D	Lawaan x Tangongon	1.128 a	0.78 b	16.81 b
	Linawaan	0.385 d	0.85 b	14.19 b
D	Del Monte Pula	0.450 cd	0.82 b	14.94 b
	Amokid	0.495 cd	0.79 b	14.89 b
L	Casilihon	0.742 b	0.82 b	15.42 b
	Ginabakid	0.595 bc	0.81 b	20.08 a
E				
	C.V. (%)	16.96	I0.23	10.61
I	Pacol x CES 2	1.887 a	0.58	7.09 d
	Sinampago	0.295 e	0.83	11.62 c
N	Bulao Luno	0.550 de	0.87	11.79 c
	Binagakay	1.062 bc	0.67	7.77 d
N	Lawaan x Tangongon	1.413 b	0.79	16.32 ab
	Linawaan	0.493 de	0.83	12.08 c
E	Del Monte Pula	0.567 de	0.75	11.96 c
	Amokid	0.585 de	0.78	12.54 bc
R	Casilihon	0.958 c	0.83	12.99 bc
	Ginabaki	0.832 cd	0.82	18.14 a
	C.V. (%)	21.9	12.75	16.18

Treatment means having a common letter are not significantly different at 5% level using DMRT.

(Lawaan x Tangongon) (Table 2). Lawaan x Tangongon, Pacol x CES 2, Casilihon, and Binagakay did not significantly vary from each other but all of them produced significantly heavier tuxies per stalk than the other 6 varieties. These differences were attributed to varietal characteristics.

Weight (kg) of Tuxies from the Middle Group.

Significant variations were noted among varieties (Table 2). Lawaan x Tangongon and Pacol x CES 2 did not markedly vary from each other but both produced significantly heavier tuxies than the other varieties. Sinampago was significantly inferior to the rest of the varieties.

Weight (kg) of the Tuxies from the Inner Group.

Significant variations were observed in the weight of tuxies from the inner group (Table 2). Pacol x CES 2 was significantly superior to the rest of the varieties. Sinampago was significantly inferior to the other varieties, except Bulao Luno, Linawaan, Del Monte Pula, and Amokid.

In general, the weight of tuxies of the 10 abaca varieties increased with the position of the leafsheaths towards the inner portion of the stalk. Most likely, this is due to the longer tuxies of the inner leafsheaths. In addition, some leafsheaths in the outer group had margins and upper ends that were already dried up. On the other hand, variations in weight among the different groups of tuxies in all varieties studied could be due to varietal differences. Varieties differed in size of stalks, which account for differences as well in the size and weight of tuxies per group of leafsheaths.

Fiber Stretch (%) of the Middle Group.

Analysis of variance showed significant differences among the varieties tested (Table 2). Bulao Luno had the highest fiber stretch followed by Linawaan, Sinampago, and Casilihon. Pacol x CES 2 had the lowest fiber stretch. These differences could be traced to varietal characteristics.

In contrast to the weight of tuxies, fiber stretch generally declined as the position of leafsheaths advanced towards the inner portion of the stalk. Also, variations in fiber stretch between and among the varieties were common and significant in the outer group. In the middle group, 9 of the 10 varieties did not differ significantly from each other, and in the inner group, no significant variations existed. These results strongly suggest that abaca varieties vary in their fiber stretch only when fiber from the outer leafsheaths are considered.

Tensile Strength (kg/g-m) of the Outer Group.

Ginabaki, Lawaan x Tangongon, and Bulao Luno were significantly superior to the other varieties (Table 2). The latter two varieties, how-

ever, were just comparable to Sinampago, Amokid, Casilihon, and Del Monte Pula. Binagakay and Linawaan were not significantly different from Sinampago, Del Monte Pula, Amokid, and Casilihon, but proved to be significantly better than Pacol x CES 2. The latter was significantly inferior to the rest of the varieties. The variations in tensile strength from the outer group may be due to varietal differences.

Tensile Strength (kg/g-m) of the Middle Group.

Results showed that fibers obtained from Ginabaki had the highest tensile strength, followed by Lawaan x Tangongon, Bulao Luno, and Sinampago (Table 2). Binagakay had the lowest fiber tensile strength. Sinampago, Bulao Luno, Lawaan x Tangongon, Linawaan, Del Monte Pula, Amokid, and Casilihon did not differ significantly from each other. Pacol x CES 2 and Binagakay were significantly inferior to the other varieties.

Tensile Strength (kg/g-m) of the Inner Group.

Varieties Sinampago, Bulao Luno, Linawaan, Del Monte Pula, Amokid and Casilihon were not significantly different from each other (Table 2). The latter two varieties, however, were just comparable to Lawaan x Tangongon, which did not vary significantly from Ginabaki. Pacol x CES 2 and Binagakay were significantly inferior to the rest of the varieties.

The morphological differences among varieties, contributed to the difference in tensile strength. In some varieties like Sinampago, Bulao Luno, Binagakay, Lawaan x Tangongon, Del Monte Pula, Amokid, and Casilihon, tensile strength declined as the position of leafsheaths advanced towards the inner portion of the stalk. However, tensile strength in varieties Ginabaki, Linawaan, and Pacol x CES 2 was higher in the middle group.

Consistently higher tensile strength in all groups of leafsheaths was obtained from Ginabaki followed by Lawaan x Tangongon, Bulao Luno, and Casilihon. These varieties show potentials for the cordage industry due to their greater tensile strength.

Fiber Quality.

Table 3 shows the fiber quality of 10 abaca varieties per group of leafsheaths. Under the Bureau of Fiber Development and Inspection Service (BFDIS) regulations, quality includes color, cleanness, fineness, texture, and length of fibers.

As normally expected and based on the results of the study, the outer group had the darkest color of fibers followed by the middle group, while the inner group had the whitest fibers in most varieties. This could be because the outer sheaths had more pigments than the inner sheaths due to exposure to sunlight.

In most varieties, it was observed that the outer group had the coarsest fibers, followed by the

Table 3. Grades of fiber[1] from the 3 groups of leafsheaths of 10 abaca varieties.

Variety	Groups	Percentage of fiber in various grades								
		S-EF	S-S2	S-S3	S-I	S-G	S-H	S-JK	S-MI	S-L
Pacol x CES 2	outer	—	—	—	—	—	—	—	—	100
	middle	—	—	—	—	—	—	—	—	100
	inner	—	—	—	—	—	—	—	—	100
Sinampago	outer	—	—	50	—	—	50	—	—	—
	middle	—	50	—	20	—	20	—	—	—
	inner	40	30	—	30	—	—	—	—	—
Bulao Luno	outer	—	—	50	—	50	—	—	—	—
	middle	50	50	—	—	—	—	—	—	—
	inner	50	30	10	10	—	—	—	—	—
Binagakay	outer	—	—	—	—	—	—	—	70	30
	middle	—	—	—	—	—	—	80	—	20
	inner	—	—	—	—	—	—	90	—	10
Lawaan x Tangongon	outer	—	—	50	—	—	50	—	—	
	middle	50	40	10	—	—	—	—	—	—
	inner	60	20	—	20	—	—	—	—	—
Linawaan	outer	—	—	50	—	50	—	—	—	—
	middle	—	70	20	10	—	—	—	—	—
	inner	—	—	80	—	—	20	—	—	—
Del Monte Pula	outer	—	—	—	50	—	50	—	—	—
	middle	—	—	—	70	—	—	30	—	—
	inner	—	—	—	—	—	—	—	80	20
Amokid	outer	—	30	30	—	20	20	—	—	—
	middle	40	40	20	—	—	—	—	—	—
	inner	50	—	50	—	—	—	—	—	—
Casilihon	outer	—	50	—	—	—	50	—	—	—
	middle	30	30	40	—	—	—	—	—	—
	inner	70	—	20	10	—	—	—	—	—
Ginabaki	outer	—	—	50	—	—	50	—	—	—
	middle	—	40	40	—	20	—	—	—	—
	inner	—	60	40	—	—	—	—	—	—

[1] Fiber quality decreases from left to right, e.g., S-EF is second to the best while S-L is the poorest. The best is S-AD and the poorest is S-Y1 but no S-AD and S-Y1 fibers were observed in this study.

middle group, while the inner group had the finest and softest fibers. These fiber qualities of the inner group may be due to the physiological age and source of fiber on the stalk. The inner sheaths are always the youngest of the groups, irrespective of the age of the plant.

Among the varieties tested, Bulao Luno, Lawaan x Tangongon, Linawaan, Casilihon, Amokid, and Ginabaki were found to have better fiber quality than the rest of the varieties. They produced more fibers of higher grade per group of leafsheaths compared to the other varieties which had poorer fiber qualities per group of leafsheaths.

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