Varietal Description:	Dry Season	Wet Season
1) Bean Yield (kg/ha)	2041	2421
2) 100 seed weight (gm)	15.0	16.6
3) Maturity (DAE)	85	99
4) Plant Height (cm)	57	91
5) Reaction to:		
Soybean Rust	MR	
Bacterial Pustule	MR	
6) Chemical Analysis:		
Crude Protein (%)	33.76	
Crude Fat (%)	19.69	
Carbohydrates (%)	31.38	

7) Agro-climatic Adaptation

The variety can be grown in all soybean regions of the countryand yields best in regions with types 3 and 4 climate and early dry season planting (September-October) for Type 1 climate. It is also recommended in rotation to corn and for post-rice cropping in regions 2 and 4.

8) Desirable characteristics

This variety is non-lodging, moderately resistant to shattering, yields are higher (exceeding the National check PSBSy 1 by 22%) and beans can be utilized both as food and feed.

Appendix 4: Proximate analysis of Soybean line LGSY 01-24 1/across locations during the wet and dry season (1987-1989)

ENTRY	Protein %	Crude fat %	Carbohydrates %	Ash %	Moisture %
LGSY 01-24	32.56	21.59	33.87	5.86	6.12
UPLSY 4 (national ck.)	35.32	19.42	32.35	5.72	7.19
BPISY 4 (regional ck.)	36.71	21.51	26.98	6.09	8.71

1/ Analyzed by the BPI, Laboratory Service Division 1987.

UTILIZATION OF SWEET POTATO (*IPOMOEA BATATAS* LINN. POIR.) FLOUR FOR OTHER FOOD PURPOSES

Edna B. Montais and Teresita Ramirez *

ABSTRACT

Sweet potato tubers of the red skin-white flesh variety were processed into flour and starch. Flour was produced by chopping pealed and unpeeled tubers and dried at 50°C in a dehydrator and at a solar simulator. Starch was likewise processed and subjected to various drying conditions. The flour and starches were further determined for its physico-chemical and rheological characteristics. Preliminary preparation of polvoron using, 30, 40 and 50% sweet potato flour were highly acceptable, hence, the level of concentration was increased to 50, 65 and 80%. Sensory evaluation results showed that the product using 80% sweet potato flour was the most acceptable as compared to the other treatments and the control which was 100% wheat flour. Brownies prepared from 50, 65 and 80% levels were also acceptable.

INTRODUCTION

Sweet potato is one of the major rootcrops grown in the country. It is usually consumed after boiling or steaming, baking or frying. Sometimes the tubers are cooked with syrup and used as a basic ingredient in the popular native delicacy "halo-halo".

However, aside from the fact that the crop is grown in the country and is available throughout the year, no major staple processed product is done commercially. Besides, only the good shaped tubers command a good market price leaving the rest classified as of non-commercial value which constitutes the bulk of post-harvest losses estimate at 35 to 95%.

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In view of the increasing cost of wheat flour, it has become necessary to substitute it with non-wheat material or indigenous sources for use in the preparation of some bakery products. This would not only cut the importation of wheat flour but would motivate the farmers to plant sweet potato and increase their income. With adequate supply of this low cash crop, processing it into flour or starch would be more practical since it would not only lead to the minimization of post-harvest wastage but would otherwise uplift the financial status of the farmers who grow the crop. This may also open up a home-scale or cottage level income-generating source by utilizing the processed flour and/or starch into some bakery products.

REVIEW OF RELATED LITERATURE

The sweet potato is a climbing herbaceous plant, the most important part of which are the roots because they can develop into tubers. The tubers are parts of the creeping roots that have built up food reserves. Varieties differ greatly in the number, shape and size of their tubers and in the color of the peel and flesh of the tubers. Sweet potatoes may be round or elongated. In color they are white, yellow, red or violet, with soft or firm flesh. The tubers are of great value as an energy food.

Sweet potatoes are utilized primarily as a human foodstuff (Shakya and Flink, 1986). In the tropics, the major proportion of the crop is eaten straight from the ground as a vegetable, after boiling, baking or frying. In Malawi, they are sometimes boiled or roasted and pounded with groundnuts to produce "futali". In some areas, notably India and parts of East Africa, the peeled tubers are sometimes sliced and dried in the sun to produce chips, which are often ground into flour. In the USA, about 60-70 percent of the sweet potato is utilized for human food and they are eaten fresh, canned, frozen or dehydrated. It is also used in a variety of products such as pie fillings, purees, candied pieces, souffles, baby foods, etc.

Sweet potato flour which is made by drum-drying of cabinet-drying the peeled sliced tubers, can be used as a partial substitute for wheat flour in bread and pastry making.

Considerable quantities of sweet potatoes, particularly the yellow types, are canned, notably in the USA, where several different styles of pack such as canned whole, slices or puree, in syrup or in water are produced. Due to heavy losses in peeling and occurrence of fermentation, canning has not proved very popular.

For dehydrated flakes, the sliced tubers are cooked for about 20 minutes before being produced to a fine pulp or puree. Approximately 100 ppm of a fungal diastase are added to the puree to partially convert the starch into sugar. After holding for 20 minutes, the puree which has a total solids (TS) content of 22-24 percent is dried on drum-driers to give a thin sheet of 97 percent total solids content, which is broken into flakes and packed in cans or polyethylene flexible pouches, flush out with nitrogen or other inert gas in order to avoid oxidation during subsequent storage.

Large-size tubers are stated to be richer in vitamins than the smaller ones and the concentration of vitamins is found to be higher in the inner core than in the outer portion. Tubers with white flesh contain practically no carotene while deeply colored varieties may contained over 7 mg/100 gms of carotene. On cooking, the tubers attain considerable sweetness owing to the hydrolysis of starch by the beta-amylose present.

Slicing versus shredding influence the ease of drying and milling. Slices are easier to handle but more difficult to dry and once dry were more difficult to mill than shreds. Shreds could be cooked more uniformly but were more subject to breakdown and erosion especially on boiling or with the pressure cooker.

In a study undertaken by Martin (1984) it was stated that pre-drying processing also influenced flour preparation. Uncooked slices and shreds were much easier to spread on drying trays and dried much more rapidly than similar cooked materials.

The yield of flour produced is dependent not only on the dry weight of the root but also on losses due to peeling and trimming. Flours

In view of the increasing cost of wheat flour, it has become necessary to substitute it with non-wheat material or indigenous sources for use in the preparation of some bakery products. This would not only cut the importation of wheat flour but would motivate the farmers to plant sweet potato and increase their income. With adequate supply of this low cash crop, processing it into flour or starch would be more practical since it would not only lead to the minimization of post-harvest wastage but would otherwise uplift the financial status of the farmers who grow the crop. This may also open up a home-scale or cottage level income-generating source by utilizing the processed flour and/or starch into some bakery products.

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Slicing versus shredding influence the ease of drying and milling. Slices are easier to handle but more difficult to dry and once dry were more difficult to mill than shreds. Shreds could be cooked more uniformly but were more subject to breakdown and erosion especially on boiling or with the pressure cooker.

In a study undertaken by Martin (1984) it was stated that pre-drying processing also influenced flour preparation. Uncooked slices and shreds were much easier to spread on drying trays and dried much more rapidly than similar cooked materials.

The yield of flour produced is dependent not only on the dry weight of the root but also on losses due to peeling and trimming. Flours were predominantly whitish or cream colored or slightly orange due to carotene content of the tubers. Cooking increased the intensity of cream, yellow and orange colors. The bulk densities ranged from 0.65-91 gm/ml in the case of uncooked flour and from 0.79-1.04 in the case of flour from cooked sweet potatoes. Bulk density decreases as particle size decreases.

OBJECTIVES

General : To determine the effects of adding or substituting wheat flour with sweet potato flour or starch in the preparation of certain bakery products.

Specific :

1. To be able to identify the processing parameters for sweet potato flour.

2. To be able to characterize the physico-chemical and rheological properties of flour and starch produced from unpeeled and peeled sweet potato tubers.

3. To be able to determine the optimum utilization of the flour and/or starch in the formulation of polvoron, brownies and cookies without significantly affecting the sensory qualities of the products.

METHOLODY

Phase 1 : Establishment of Processing Parameters

A. Starch Extraction:

Sweet potato of red skin, cream flesh variety was utilized for extracting the starch. Lot A consisted of peeled tubers while Lot B were unpeeled ones. The roots were chopped, osterized with the addition of sufficient quantity of water to facilitate grinding and passed through muslin cloth to extract the starch from the pulp.

The liquid was allowed to sediment for 3 hours washed with distilled water twice after each sedimentation and let to stand overnight for the starch to completely settle. The starch collected consisted of wet sample while the others were subjected to various drying conditions in the Hedin dehydrator at 30°C, 70°C 90°C and under the solar simulator.

The various starches were further determined for its color through a Chroma meter moisture content by vacuum-oven method and the rheological characteristtics by means of Brabender Amylograph.

B. Flour Pruduction:

Chopped peeled and unpeeled sweet potato tubers were dried at 50°C in a dehydrator and at a solar simulator, respectively. The dried chips were milled in a Homer Mill and sieved in 0.032"-mesh sieve (standard mesh for wheat flour) for uniformity of particles of the flour.

Phase 2 : Physico-chemical Analysis of Starch and Flour

A. Moisture Determination

The 1984 AOAC procedure for Vacuum Oven Method for moisture analysis was followed.

B. Colorimetry

The color, lightness and saturation of the starch and flour were determined by putting 10 grams of the samples in a disc and the above characteristics were taken and measured by exposing it to a Chroma Meter. The above properties were expressed in terms of hue (1) for color, value (a) for lightness and darkness, and chroma (b) for vivid or dull colors.

C. Rheological Characteristics

The viscosity of the different sweet potato starches and flour was determined from the curves obtained from the Brabender Amylograph. Five per cent starch suspension was prepared to make 450 ml volume and poured into the measuring vessel of the amylograph. The viscosity was recorded at a constant rotational velocity using 700 cmg cartridge with a uniform rise in temperature at a rate of 1.5°C per minute at controlled heating.

When the temperature reached 95°C it was held for 20 minutes having the paste stirred constantly. After the "holding period", the paste was cooled uniformly until the temperature of 50°C was attained.

Phase 3 : Utilization of the Flour

A standard formulation for polvoron using 100% wheat flour served as the control. Three treated formulations using 30, 40, and 50% sweet potato flour were substituted to wheat flour in the preparation of polvoron. Cooking time for the flour formulations were likewise standardized.

Since the results of sensory evaluation for the preliminary trial using sweet potato flour at 50% was still generally acceptable (Table 11), the addition of sweet potato flour was increased to 50%, 65% and 80%, respectively, in the preparation of polvoron and brownies. A standard formulation using 100% wheat flour served as the control (Appendix 1).

RESULTS AND DISCUSSIONS

Phase 1. Establishment of Processing Parameters

A. Sweet Potato Starch

The recovery of starch from the sweet potato tuber which ranges

from 4.96% to 7.63% for the dried samples (Table 1). the wet starch has 9.560% for the peeled tuber and 10.06% for the unpeeled.

Table 1. Recovery of Different Starches from Sweet Potato Tuber

Sweet Potato Starches	% Recovery
Starch Dried at 30°C(Hedin)	7.63
Starch dried at 70°C(Hedin)	6.89
Starch dried at 90°C(Hedin)	4.96
Starch dried under solar simulator (30°C)	7.33
Wet starch (Peeled)	9.56
Wet starch (Unpeeled)	10.06

The starches both dried at 30°C in the dehydrator and under the solar simulator, respectively, has almost the same recovery. The starch dried at 90°C has lower recovery since at higher temperature, greater water loss was manifested during the drying process.

The rate of recovery can be correlated to the moisture content of the different starches (Table 2). The starch dried at 90°C has a moisture content of 2.68% while at a lower temperature, 30°C for both starches dried in the dehydrator and solar simulator the moisture content was determined at 11.59 and 13.87 level.

Table 2. Moisture Analysis of Different Starches from Sweet Potato Tuber

Sweet Potato Starches	Average Moisture Content (%)
Starch dried at 30°C	11.59
Starch dried at 70°C	5.52
Starch dried at 90°C	2.68
Starch dried under solar simulator (30°C)	13.87
Wet Starch (Peeled)	44.77
Wet Starch (Unpeeled)	46.40

B. Sweet Potato Flour

The sweet potato flour has higher recovery rate than the starch since the whole pulp was utilized in the processing (Table 3). The flour produced from the peeled tubers ranges from 20.95 to 22.04% after a drying period of six hours (Table 4). This further accounts to the moisture content of the flour produced from drying the chips under different conditions (Table 5). The best quality sweet potato flour was those unpared from the peeled tubers dried at 50 °C in a dehydrator.

Table 3. Recovery of Flour from Sweet Potato Tuber

Drying Condition	% Recovery
50°C, peeled	23.18
50°C, unpeeled	22.04
Solar simulator, peeled	23.06
Solar simulator, unpeeled	20.95

Table 4. Moisture Loss of Peeled and Unpeeled Sweet Potato Chips Dried in the Dehydrator and Under Solar Simulator

Sweet Potato	% Moisture Loss					
Chips	1 hr	2 hr	3 hr	4 hr	5 hr	6 hr
50°C,peeled	37.10	52.69	61.47	67.21	70.29	72.41
50°C,unpeeled	13.71	20.46	27.79	34.27	40.07	46.37
Solar simulator peeled	19.54	34.02	28.03	55.74	61.47	65.60
Solar simulator unpeeled	6.29	12.50	19.20	26.36	32.64	38.57

Table 5. Moisture Analysis of Sweet Potato Flour from Peeled and Unpeeled Tubers

Drying Conditions	% Dry Matter	% Moisture	Average
50°C peeled	95.65	4.35	4.1
	96.00	4.00	
50°C unpeeled	95.25	4.75	5.09
	94.57	5.43	
Solar simulator peeled	92.51	7.49	7.52
	92.44	7.56	
Solar simulator unpeeled	91.09	8.91	8.81
	91.29	8.71	

Phase 2. Physico-chemical Analysis of Sweet Potato Flour and Starch

A.Physico-chemical Analysis

The chemical composition of sweet potato flour and starch which were processed at different drying conditions, *i.e.* in a dehydrator and in a solar simulator is shown in Table 6.

Table 6. Chemical Composition of flour and starch of Sweet Potato tubers processed at varied drying conditions (%).

	Moisture %	Ash %	Crude Fat	Crude Protein	Carbohy-drates
Flour					
50°C Peeled	8.19	4.82	0.64	4.30	82.09
50°C Unpeeled	8.12	4.78	0.83	3.79	82.48
Solar simulator Peeled	10.02	4.06	0.44	3.90	81.58
Solar simulator Unpeeled	10.19	4.80	0.64	4.15	80.22
Starch					
Solar simulator	10.69	0.12	0.14	0.01	89.04
30°C	9.14	0.14	0.14	0.02	90.5
70°C	3.84	0.13	0.34	0.13	95.56
90°C	5.32	0.12	0.05	0.14	94.37

The flour processed from peeled sweet potato tubers dried at 50 °C was found to contain the highest crude protein at 4.30%. The ash cohtent ranges from 4.06% to 4.82%. The flour made from the unpeeled tubers dried at 50°C contains 82.48% carbohydrates.

As for the sweet potato starch, the sample dried at 70°C exhibited the highest carbohydrate at 95.56%. However, the other nutritional components such as crude protein, crude fat and ash were found to be at very low levels.

B. Colorimetry

Results showed that the starch dried at 90°C is the most white among the samples dried at different drying conditions, *i.e.* drying at 30°C to 90°C in a dehydrator ant at 35°C in a solar simulator. At higher temperature the starch can be safely dried to obtain a whiter product (Table 7).

Table 7. Colorimetry Test Results on Sweet Potato Starch

Sweet Potato Starch	L	a	b
Starch dried at 30°C(4 hrs)	86.10	0.75	4.88
Starch dried at 70°C(1½ hrs)	88.95	0.88	5.4
Starch dried at 90°C(1 hr)	90.00	1.00	4.85
Starch dried under solar simulator at 35°C(3½ hr)	87.82	0.73	4.75
Wet starch peeled	88.25	1.38	4.60
Wet starch unpeeled	84.05	0.80	6.88

The flour made from peeled tubers dried at 50°C is the most white among samples both dried in a dehydrator and in a solar simulator (Table 8).

Table 8. Colorimetry Test Results on Sweet Potato Flour

Sweet Potato Flour	L	a	b
Peeled tuber, 50°C	84.10	1.97	16.65
Unpeeled tuber, 50°C	79.08	0.43	15.33
Peeled tuber, solar simulator (35°C)	76.83	0.08	16.20
Unpeeled tuber, solar simulator (35°C)	71.90	1.25	16.13

C. Rheological Characteristics

The rheological characteristics of sweet potato starch is shown in Table 9. The starch dried at 30°C gelatinized at 74.8°C and has the same viscosity of 460 B.U. (Brabender Units) upon reaching 95°C. However, upon lowering the temperature to 50°C, the starch dried at 70°C is more viscous with a reading of 780 B.U. Among the four samples dried under different conditions, the starch that was dried under the solar simulator showed a higher gelatinization characteristic at 80°C and has a higher viscosity upon cooling (Table 9).

Table 9. Rheological Characteristics of Various Sweet Potato Starches.

Sweet Potato Starches	Gelatinization Temp.(°C)	Peak Viscosity e Temp. (B.U.)	Viscosity (B.U.)		
			95°C	After 20 mins. at 95°C	at 50°C on cooling
Dried at 30°C	74.8	420	460	490	770
Dried at 70°C	75.5	440	460	540	780
Dried at 90°C	77.2	260	350	390	690
Under solar simulator, 35°C	80.0	430	500	560	840
Wet, Peeled	75.5	280	330	350	560
Wet, Unpeeled	74.6	360	340	360	550

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Since the recovery of the sweet potato starch was comparatively very low, it was decided that only the sweet potato flour was utilized in the preparation of certain bakery products such as polvoron and brownies.

Phase 3. Utilization of Sweet Potato Flour

Sweet potato flour was utilized in the preparation of some products like polvoron and brownies. In the preliminary formulation of polvoron, sweet potato flour was used at 30%, 40%, 50% levels. Sweet potato flour was added to wheat flour to form a composite mixture. Results of sensory evaluation showed that all the polvoron formulation were acceptable. Likewise, statistical analysis showed that addition of sweet potato flour has no significant effect on the sensory qualities of the product.

Another lot of sweet potato flour was processed using the red skin-cream flesh type "Tinurong" cultivar. On the basis of the favorable outcome of the preliminary trial, the addition of sweet potato flour was increased to 50%, 65% and 80%, respectively, to maximize its utilization. These levels of concentration were used in the preparation of polvoron and brownies.

A comparative study on the attributes of the four formulations of polvoron showed that the binding property decreases as the addition of sweet potato flour increases. The three treated products (50%, 65% and 80%) seem to be dry and need more liquid so that it will not crumble easily.

The chemical composition (Table 10) of the raw tubers and the processed product, polvoron, was determined. Among the three treated formulations, the sample using 50% sweet potato flour has the highest protein content at 9.28%. Microbiological examination of the polvoron also gave satisfactory results.

Table 10. Chemical Analysis of Sweet Potato Tuber and Polvoron (%).

	Moisture	Ash	Crude Fat	Crude Protein	Carbohy-drates
Sweet Potato Tuber	57.56	0.69	0.46	1.97	39.32
Sweet Potato Flour	9.19	1.56	0.71	3.15	85.39
Polvoron 5050	3.20	1.68	21.36	9.28	64.48
Polvoron 3565	3.35	1.69	21.22	9.22	64.52
Polvoron 2080	3.86	1.44	21.24	7.82	65.64
Control WF 100	2.30	1.48	21.10	10.50	64.62

Although the sensory evaluation of the Brownies showed that the product was acceptable, it has a tough texture particularly with the sample using 80% sweet potato flour. This characteristic could be attributed to the outstanding suitability of the wheat flour to yield a soft crumb which is due to the property of the proteins that swells with water to give the so called gluten was observed to be different in the sweet potato flour.

Moreover, this could also be due to the amylose, the linear fraction of starch, which is one of the important factors that influences the cooking and eating qualities of milled rice. In a study conducted on the amylose content in rice, varieties with low amylose contents are firm, moist and sticky when cooked (Juliano,1971). These are mostly preferred by consumers because they remain soft even after cooking.

Similarly, the amylose content of sweet potato may also have an influence on the texture of the cooked tubers as well as the breadmaking properties of the flour.

If 100% wheat flour is used in the usual breadmaking formulation, a light structural product is readily obtained. However, if pure starch or flour from other sources is utilized, the product is considerably more rigid and its texture is irregular because gas id insufficiently retained in the dough and the gas cells are less stable.

Some studies showed that it is also possible to prepare some bakery products from sources that do not contain gluten-forming proteins, provided that a swelling or binding agent is added when the dough is prepared. The binding substance used in the study of preparing bakery products from composite flour is commonly called glyceryl monostearate (GMS).

CONCLUSIONS

In the processing of sweet potato starch, it can be concluded that it can be dried at a temperature of 90°C to get a most white product. The starch dried at lower temperature of 35°C has a higher gelatinization characteristic of 500 Brabender Units (B.U.) during heating at 95°C and a relatively higher viscosity of 840 B.U. upon cooling down to 50°C. However, due to a very low recovery, an average of 6.5%, its utilization was not considered in this study.

The processing of sweet potato flour from peeled tubers has a recovery of 23%. This was due to a high moisture loss of 72.4% after 6 hours of drying at 50°C which gave the product a moisture content of 4.1%

The sweet potato flour was utilized in the preparation of polvoron and brownies at a maximum concentration of 80% for both products. Polvoron was the most preferred and rated as the most acceptable as compared to the control which was made from 100% wheat flour and the two other treatments, 50 and 65%.

Table 11. Comparison of chemical properties of sweet potato flour to other flours. (in percent)

	Prot.	Moist.	Fat	Ash	CHO
Sweet Potato Flour	3.15	9.19	0.71	1.56	85.39
Ipil-ipil Flour	50.60	7.39	7.78	3.26	34.23
Berczeller's Soya Flour	41.50	8.97	20.36	3.92	24.80
Finest Wheaten Flour	10.68	12.63	1.63	0.52	74.69
Rye Flour	9.62	12.58	1.44	1.17	73.84
Oatmeal Flour	13.87	9.09	6.18	2.07	67.06
Maize Flour	9.62	12.99	3.14	1.14	71.70
Bean Flour	23.23	10.57	2.14	3.36	58.92
Pea Flour	25.72	11.28	1.78	2.78	57.18

Table 11 shows the comparison of sweet potato flour to other flours from indigenous sources (Montais, 1978). Sweet potato flour can be a very good source of carbohydrates in the diet. It has high potentials in the baking industry through its utilization in the numerous value added processed products.

RECOMMENDATION

It is highly recommended that a more extensive study on the utilization of sweet potato flour be under taken to exploit its potentials. Its utilization in bakery products must be maximized without significantly affecting the sensory attributes of the product.

Likewise, a more comprehensive study on the correlation between the amylose and starch content should be conducted as it affect the processing qualities of the root crop.

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APPENDICES

Appendix 1. Anova for color of polvoron treated with 50, 60, and 80% sweet potato flour.

Source of Variation	df	SS	MS	Fc	Ft	CV
Samples	3	32.08	10.69	9.29	2.96	20.26
Panelists	9	37.53	4.17			
Error	27	31.17	1.15			
Total	39	100.78				

Ha: at 5% level, samples are significantly different from each other.

Appendix 2. Anova for color of polvoron treated with 50, 60, and 80% sweet potato flour.

Source of Variation	df	SS	MS	Fc	Ft	CV
Samples	3	22.5	7.5	7	2.96	17.92
Panelists	9	30.4	3.37			
Error	27	29	1.07			
Total	39	81.9				

Ha: at 5% level, samples are significantly different from each other.

Appendix 3. Anova for color of polvoron treated with 50, 60, and 80% sweet potato flour.

S V	df	SS	MS	Fc	Ft	CV
Samples	3	33.4	11.13	10.21	2.96	18.47
Panelists	9	32.6	3.62			
Error	27	29.6	1.09			
Total	39	95.6				

Ha: at 5% level, samples are significantly different from each other

Appendix 4. Anova for color of polvoron treated with 50, 60, and 80% sweet potato flour.

S V	df	SS	MS	Fc	Ft	CV
Samples	3	2.08	0.69	0.93	2.96	11.69
Panelists	9	32.53	3.61			
Error	27	20.17	0.74			
Total	39	54.78				

Ha: at 5% level, samples are significantly different from each other

Appendix 5. Anova for color of polvoron treated with 50, 60, and 80% sweet potato flour.

S V	df	SS	MS	Fc	Ft	CV
Samples	3	27.28	9.09	10.69	2.96	14.34
Panelists	9	36.53	4.05			
Error	27	22.97	0.85			
Total	39	86.78				

Ha: at 5% level, samples are significantly different from each other

Appendix 6. Anova for color of polvoron treated with 50, 60, and 80% sweet potato flour.

Attributes Samples	A	B	C	D
Color	5.7	5.2	4.7	7.1
Texture	5.7	5.7	5.2	7.2
Flavor	6	5.5	4.8	7.3
Aroma	6.1	6.3	6.2	6.7
General Acceptability	0.57	5.6	5.1	7.3

LOCAL PAPERS AS SUBSTITUTE FOR NITROCELLULOSE MEMBRANE IN THE DETECTION OF BACTERIAL WILT LATENT INFECTION OF POTATO

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ABSTRACT

Eight locally produced papers were evaluated as possible substitute for expensive and imported nitrocellulose membrane. NCM - ELISA, a method of bacterial wilt testing developed by CIP, Lima, Peru was used as guide in the conduct of the study.

Among the materials tested, three gave promising results. These were Cactus Xerox paper, Ordinary Xerox Paper and Vernal Mimeographing paper (Substance 20). The purple coloration of the papers which corresponded to positive results were comparable or the same as that in Nitrocellulose membrane. It was found out that the antisera for the test could be recycled or utilized once.

Based on the results of the test, it was observed that 38.63% of the tubers of plants adjacent to bacterial wilt - infected hills were latently infected with the disease.

INTRODUCTION

Bacterial wilt disease incidence in Benguet and in Mindanao causes crop damage as high as 70 - 100%. Plants with latent infection do not show any visual symptoms of the disease. This situation poses a serious threat in the seed potato production because it is hard to pinpoint which among apparently - healthy - looking plants are infected.

The detection of latent infection can now be done by the use of expensive and imported materials like nitrocellulose membrane. Hence, alternative materials have been taken into considerations and the possibility

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