PROF. MABINI DG DIZON
LECTURER, ENG 10 C and T

UNIT IV

THE RESEARCH REPORT

RESULTS AND DISCUSSION

SUMMARY AND CONCLUSION

ABSTRACT

POSTER PAPER

I. RESULTS AND DISCUSSION

A. This section corresponds to the data analysis and interpretation stages of the research process.

Functions: Presents data in an organized manner.

Derives and discusses generalizations from the data.

Establishes highest and lowest data values (the data range) if there are any, as well as other values of special interest.

Links findings established by the research with one another as well as to previous findings.

Offers explanations for expected as well as for unexpected results.

Content: Tabulated data in their final form, unless these are designated as appendices at the end of the paper.

Graphs and illustrations relevant to the discussions presented.

Discussions and explanations about the data to explain relationships among them and findings because of them (trends, patterns, quantitative and/or qualitative information, causes and effects, errors, etc.)

Treatment: This may be presented as one section or divided into two, one for results and another for discussion.

Tables, graphs, charts, illustrations and sometimes photographs, as well as text in paragraph form are used to present the content of this section.

Statements should be supportive of each other.

In the sentences of the discussion, use phrases like "…may be due to…" and "…seem to…" which hint of probability rather the definiteness.

Expository techniques should also be relied on.

Example 1:

…Phytoalexins were extracted from the leaves of two resistant and one susceptible variety (*sic*) of peanut inoculated with *Cercospora arachidiola*...

Example 2:

…A comparison of ligninase production between shakeflask and stationary cultures of *P. chrysosporium* was made to determine if the particular strain of fungus to be used is capable of producing the enzyme in both cultures…

Example 3:

…In order to provide a tool in conducting randomization and constructing layouts for researchers, a statistical package was created to perform such a task…

Example 4:

…Basic problems were encountered regarding the determination of nitrogen absorption of foliar applied urea. First was the elimination of N-analysis of the water wash from the leaf samples at the end of each sampling…

B. Graphic Materials for Data Presentation

Whenever you must present numerous figures, well-planned graphic materials can help give the picture more quickly -- and interestingly -- for readers. The following are brief explanations of those popular graphics:

1. Tables

- when you need to present quantitative information systematically in rows and columns
- title of rows are usually called 'stubs' and titles of columns are called 'captions.'
- more appropriate for precise numerical information

Detailed statistical material may be presented in tables rather than in the text of the paper. Tables should be used to supplement but not to duplicate material in the text. Each table should present one subject or one kind of data rather than a complexity of ideas or comparisons of different kinds (Berry and Martin, 1972). This does not imply that it may not have several columns of data but one table should not try to convey too many ideas and relationships. A table found in the body of the thesis should be brief (Campbell, 1954).

Rules regarding tables are given below. See the most recent issues of Food Technology for examples of tables. Samples of tables are given in Figure 22.

a. The table should appear as near as possible to the discussion that relates to it. It should never precede the first discussion of its contents.

b. If the table is short and is to be placed on a page with context but cannot be accommodated on the page where first mentioned of it occurs, it should normally be placed on the next page at the end of the paragraph.

c. If a table occurs on the page with or immediately following the first discussion of its contents, only the number of the table (not the page number) need be given. If, however, reference is made to a table at any point other than on the same or the preceding page, both the table number and number of the page on which it occurs must be given.

d. Tables should be numbered consecutively throughout the thesis, from first to last, even if some of them appear in the appendix. Use Arabic numerals in numbering tables. The word Table followed by the appropriate number is placed before the title of the table.

e. The caption should be placed above a table and should be written in caps and lower-case letters in paragraph or underhung with terminal punctuation.

f. When a table will fit on a page broadside but not in normal position, it is so placed that the caption will be on the binding side.

g. Superfluous words, such as "table showing" or "chart representing", should be avoided in all captions.

h. Each column heading should be centered in the space allotted to its column.

i. In ruling the table, double horizontal rules should be placed at the top of the table, a single horizontal rule below the column headings, and single or double horizontal rules at the bottom of the table.

Solid lines may be omitted in the construction of tables as long as there are no possibilities of error and misreading.

j. When a table is long that it must be continued on the next page, the ensuing pages, the entire arrangement on each such page is the same as on the first, except that only the table number and the parenthesized word "continued" replace the table number and the original caption.

2. Graphs

- Useful for the interpretation of the relationship between variables

a. Bar Graph
   - Easy to construct and understand, one of the most common and adaptable types of graphic presentation
   - the bars of equal width but varying lengths help to show changes and comparisons in certain areas
   - careful labeling is necessary for the bars and the units in which the values are measured
   - though there are other variations of bar graphs, three types you will probably use more often in your reports are:

   ➢ Vertical bars
   - when a time factor is considered vertical bars are specifically useful

   ➢ Horizontal

- may involve single bar or multiple bar which compare two or three variables
- scale in bottom line may list percentage, pesos, dollars. etc.
- Each horizontal bar begins on the vertical line at left and each has a name
- For extra clarity, you can have both a bottom scale and figures within the bar. With or without a bottom scale, every bar must be in exact correct proportion according to a specific scale. Other variations include showing totals or percentages as bar ends.

➢ Subdivided/Component

- shows constituent elements, or parts of a whole area or subject that is being compared with other subjects
- Each part of a bar has a certain color, shading etc. to distinguish it from other components
- a legend explains all the markings

b. Line Graphs

- Portrays a trend or series of figures covering a large number of time periods
- Time scale is usually across the bottom while the magnitude are placed near a left hand vertical line.
- Peaks are clearly marked with figures

c. Pie Chart

- Shows relative sizes of parts in a whole or group
- Make comparison of facts easier
- Each of the pie should be clearly labeled.

d. Pictogram

- Similar to horizontal and vertical bar graphs except that pictures relevant to the data are used
- Graphic software packages for word processors permit many additional designs and colors

e. Maps

- reveal geographic facts and compositions
- shows locations of natural resources, etc.

f. Others

- organizational chart, flow chart, pictures

C. Essentials for Correct Presentation

The following brief suggestions give you a general overview of the essentials for correct presentation of graphic materials in your report.

1. Placement
   Usually the best place for each illustration is within the text of discussion if it is directly relevant and the reader will need to refer to it while reading the report. Place it as close to the discussion as possible – preferably in the same paragraph or page (or if it is long, on the immediately following pages).

2. Introduction and interpretation

- Always introduce the reader to the illustration before you show it. This can be done in one to three sentences
- Emphasize the highlights, averages, extremes, or other significant aspects of the illustration
- Do not detail minute data. Such unnecessary repetition will be boring and wasteful of space and reading time
- If the graphic is so simple that its meaning is obvious, omit interpretations because they may be insulting to the reader's intelligence

3. Lead – in sentence
   The sentence just before the visual aid may end with words like "as the following table (chart, graph) shows (or illustrates) …"

4. Numbers
- Normally do not number small tables, charts, graphs, etc. when they are placed with a paragraph and occupy only few lines
- In longer reports, however, if you have several formal illustrations with a complex data, these should be numbered separately
- All illustrations should have meaningful titles. If desirable, the titles can then be included in separate lists of tables and charts after the table of contents for easy reference.

5. Expression of figures
- Express important figures as simply and meaningfully as possible – perhaps in percentages, ranks or rounded-off numbers
- Reader can more easily compare 3 percent with 75 percent (or P8,000 with P200,000) than P8,243.21 with P206,080.25. Put figures in context: "Profits rose 9.9% last year, the highest rise in the company's history."

D. Guide Questions For Interpretation of Data:

1. What are the data/results?

2. How do the data/results compare with one another?

   2.1 quantitatively, e.q. the highest, the lowest, the least quantitatively, e.g. in terms of color, texture, shape, educational attainment

   2.2 Are there obvious, discernible trends/patterns?

   2.3 How are the variables interrelated?

   2.4 What are the observed characteristics – physiological, morphological, socio-cultural

   2.5 Were the data/results subjected to statistical analysis?

   2.6 Are the data classifiable? By what criteria?

3. What results did pervious studies obtain?
   How do they compare with the results of this study?

4. What are the theoretical implications of the data?
   Are there theories that can explain the data?
   Do the data confirm/refute the hypothesis?

5. Are there technical terms involved in the interpretation that need to be defined for clarification?

6. What specific conclusions can be derived?

E. Statements of <u>Presentation</u> and <u>Interpretation</u>:

1. …storage at 10 ^{0}C greatly extended the storage life of [the] fruits to about 18.6 days compared to 3.5 days for [the] fruits kept at ambient temperature (32 ^{0}C), apparently indicating the favorable effect of cold storage conditions on the keeping quality of stored commodities. Low

temperature storage has been known to slow down the metabolic activity particularly that of the degradative processes associated with harvested fruits such as starch breakdown, chlorophyll degradation, and respiratory activity. (Phil. Agric. 71 (1) : 3)

2. These results as well as the preceding observations clearly indicate that if ripening is accelerated, senescent spotting is concomitantly increased. Treatments that delay ripening also reduced the incidence of spotting (Phil. Agric. 71 (1) : 12)

3. The findings in this study confirmed the data of other investigations (Mislives and Trite, 1970b). (PA 71 (1) : 41)

4. It was observed during the entire experiment that the maintenance of continuous burning process was affected more by the rate of feeding the rice hull into the combustion chamber than by the amount of primary air supplied.

   This observation was confirmed by the statistical analysis of the different responses as shown by analysis of variance (Table 1). The effect of factor B (feed rate) was highly significant as compared to the effect of factor A (air flow rate) where no statistical significance was indicated. (PA 56 (9 & 10) : 332-333).

5. The result of the experiment is presented in graphical form. Hulling result is evaluated and discussed based on two criteria: the percentage of hulled grain and the head grain recovery of brown rice.

6. Based on these findings, it appears that in three out of five non-farming decision areas, decision making was made jointly by husband and wife. These areas were education of family members, adoption of family planning methods, and delegation of responsibilities of children. On the other hand, procurement of household appliances was a wife-dominated decision areas, while house renovation was decided mostly by the husband. (Dev Com Q 2 (2) : 39).

II. SUMMARY AND CONCLUSION(S)

Functions:	The Summary presents the highlights of the research in précis form.
	The Conclusion(s) states which of the objectives were attained or not, as well as the hypotheses that were accepted or rejected.
Contents:	A capsulized overview of the entire research.
	Concluding statements.
Treatment:	Both summary and conclusion(s) are usually contained in one section.
	Present and past tenses are usually employed.
	Length involves only several paragraphs.

Example 1:

…It was found out that of the 29 phenotypic traits only 11 were significant or relevant in the clustering procedures in pine plantations using discriminant analysis…

Example 2:

…Results showed that the number of bands increased by two to five after inoculation…

Example 3:

The integral approach in proving the properties of transcendental function is, therefore, an alternative to the traditional methods of proofs. Moreover, this can support the notion that these functions together with their properties are already established and…

Example 4:

…From the results, it can be concluded that in batch anaerobic fermentation of coconut skimmilk, VFA production could be optimized by pH 6.0 to 6.5, 1:dilution and retention time of 24 hours…

Example 5:

…Based on this study, however, no conclusive statements can be made on the optimum age for alkaloid production because the plants had powdery mildew in the later stage of growth.

III. IMPLICATIONS

Functions:	Relates the research and its results to the current status of similar activities in its discipline.
	Identifies new problems encountered (if there were any) and gives possible solutions to these problems.
	Recommends possible areas for future research endeavors, thereby maintaining the continuity of the research process.
Content:	A short status update relating the research to its discipline.
	New problems encountered, if any.
	Suggestions for further research(es).
Treatment:	Expository techniques and present and past tenses should be employed.
	New problems encountered and/or research suggestions may be presented in paragraph list formats, or a combination of both.

Example 1:

…Knowledge on phytoalexin could facilitate breeding work in the development of peanut varieties resistant to *Cercospora* leaf spot…

Example 2:

…This study found, however, that community newspapers also had a limited reach. In the Southern Tagalog region, it was found that community newspapers existed and survived in urban communities which were the centers of socio-political and economic activities in the provinces where they were located. This signifies that the characteristics of urban areas (e.g., high literacy, high per capita income, the presence of mass media which motivate further use of the same), influenced the existence of a community newspaper. It may be inferred then that since these features are non-existent in rural areas, the prospect is dim for a community newspaper to thrive there.

IV. LITERATURE CITED/REFERENCES/BIBLIOGRAPHY

Literature Cited – Heading used if citations are found solely in the review of literature.

References – Heading used if citations are found in other parts of the research proposal or report, as well as those found in the review of literature.

Bibliography – Heading used if other references aside from those used are included in this section. Some research reports and scientific papers, for example, include suggestions for further reading in this section.

Functions: Presents a systematic acknowledgement of the references relevant to the research being proposed or done.

Indicates a convenient information trail for other readers who might need to do a little "exploring" of their own.

Content: Complete bibliographic information: author's(s') name(s), latest year of publication, title of work, name of publication (in case of articles) and its volume and number, pages where found, place of publishing and publisher (in case of books).

Treatment: Entries are usually presented in an unnumbered list, arranged alphabetically according to the major author's family name.

Other possible list arrangements are numbered and arranged alphabetically, and numbered according to order of appearance in the text, but these are seldom used today.

Entries are negatively indented for easy access and indexing.

The title of a book or journal may or may not be *italicized.*

V. SAMPLE ARTICLES

A. Results and Discussion/Summary and Conclusion/Abstract

HEIGHT GROWTH AND SURVIVAL OF BENGUET PINE
(PINUS INSULARIS ENDL.) GROWN IN VARIOUS POTTING MEDIA

Cesar A. Orallo

BACKGROUND INFORMATION

Soil type is one of the determinants in plant growth and survival. A knowledge of the most suitable soil medium for raising planting materials is therefore very important. This exploratory study was initiated to determine growth and survival of pine seedlings grown in various potting media.

Marrero (1991) noted that pine seedlings grown in sphagnum moss were much taller at planting time, an important aid to survival during the first year in the field, aside from the fact that the time and labor in transporting potted seedlings in moss is lesser than for seedlings in soil. The seedlings growing in moss were about twice as tall as the seedlings growing in soil and were 23% taller than those growing in the mixture of sandy soil and vermiculite. Barres (1994) also found that pine seedlings grew tallest in vermiculite.

Zabala and Sargento (1994) reported that survival and growth of Kaaton bangkal *(Anthcephalus chinensis)* Rich. ex. Walp were affected by the soil in which it was grown.

MATERIALS AND METHODS

Benguet pine seedlings with the average height of 5.22 cm were potted in 10.08 cm x 15.24 cm x .002 mm polyethylene bags using different soil media as follows:

ordinary topsoil
decomposing Benguet pine sawdust
pulverized sphagnum moss
sawdust and moss mixture (1:1)
topsoil and moss mixture (1:1)
sawdust and topsoil mixture (1:1)
topsoil and sawdust and moss mixture (1:1:1)

Seventy-five seedlings were potted in each medium. The potted seedlings were laid under natural nursery conditions in a completely randomized design with three replications, 25 seedlings per replicate per potting medium.

RESULTS AND DISCUSSION

Height Growth

The analysis of variance using CRD revealed that there were very highly significant differences between the treatments.

The seedlings potted in sphagnum moss had the highest growth in height (18 cm), followed by the 1:1 mixture of topsoil and moss (17.20 cm) and topsoil (11.17 cm). On the other hand, the 1:1:1 mixture of topsoil-sawdust-moss gave the lowest 1(7.73 cm). Sawdust and its 1:1 mixture gave intermediate growth (Table 1).

Table 1. Height growth of Benguet pine seedlings potted in various media

Potting Media	Ave. Height Growth (cm) in Months After Potting				
	Initial	1	2	3	4
Sphagnum moss	5.35	6.25	10.48	18.65	18.00a
Topsoil-moss (1:1)	5.53	7.02	8.62	12.43	17.20a
Topsoil	5.08	6.07	7.24	7.95	11.17a
Topsoil-sawdust (1:1)	4.62	4.98	6.39	6.85	8.86b
Decomposed sawdust	4.65	5.98	6.79	7.26	8.53b
Sawdust-moss (1:1)	5.13	5.67	6.69	7.00	8.07b
Topsoil-sawdust-moss (1:1:1)	5.32	5.39	6.17	6.60	7.73b

a,b Means with the same letters are not significantly different at 1% level.

Soil has a direct effect on plant growth and development. It is the medium through which root development is attained, and moisture and nutrients for vital plant processes are supplied (Zabala and Sargento, 1991). The result of this study conforms with the findings of Dalmacio (1990) that sphagnum moss as potting medium is more suited than rice hull, ash, sawdust, and nursery soil in terms of survival and height growth.

A study conducted by Marrero (1992) on Honduras showed that seedlings grown in sphagnum moss were about twice as tall as the seedlings grown in soil and were 23% taller than those growing in the

mixture of sandy soil and vermiculite. Likewise, mahogany (*Swietenia maccrophylla*), blue mahoe *(Hibiscus elatus),* plumajillo (*Schizolabium* sp.), and primavera (*Cybistax donnelsmithii*), have also been grown successfully in sphagnum moss.

Survival

Sufficiently high survival rates were obtained in all seven potting media. No significant differences among the treatments were observed (Table 2).

Table 2. Survival of Benguet pine seedlings four months after potting in various soil media

Potting Media	**Survival at 4 months (%)**
Topsoil	89
Sawdust	87
Sphagnum moss	89
Sawdust-moss (1:1)	89
Topsoil-moss (1:1)	88
Topsoil-sawdust (1:1)	87
Topsoil-sawdust-moss (1:1:1)	88

SUMMARY AND CONCLUSION

This study determined the effect of various potting media on the height growth and survival of Benguet pine seedlings. The different potting media used were:

ordinary topsoil
decomposed sawdust
pulverized sphagnum moss
sawdust and moss mixture (1:1)
topsoil and moss mixture (1:1)
sawdust and topsoil mixture (1:1)
topsoil and sawdust and moss mixture (1:1)

The highest growth in height was shown by the pine seedlings potted in sphagnum moss, followed by those in the topsoil and moss mixture and topsoil. The lowest was shown by those in the topsoil-sawdust-moss mixture. The sawdust and its mixture media showed the intermediate height growth rates.

High survival rates were obtained in all the seven media with no significant differences among them.

The results of the study showed that sphagnum moss is the best potting media for Benguet pine seedlings in terms of height growth and survival.

PROF. MABINI DG DIZON
LECTURER, ENG 10 C and T

ABSTRACT

This study determined the effect of various potting media on the height growth and survival of Benguet pine seedlings. The highest growth in height was shown by the pine seedlings potted in sphagnum moss, followed by those in the topsoil and moss mixture and topsoil. High survival rates were obtained in all the seven media with no significant differences among them.

B. Article Digests

Philipp. Agric. Scientist 87:101-109 (2004)
DEVELOPMENT OF FOOD PRODUCTS FROM DEPHYTINIZED AND STABILIZED RICE BRAN

Wilma A. Hurtada[1] and Maria Angeline B. Cosico[2]
[1]Associate Professor, Institute of Human Nutrition and Food, College of Human Ecology, University of the Philippines Los Baños, College, Laguna 4031, Philippines (Corresponding author; e-mail: wilmahurtada@yahoo.com)

[2]University Research Associate, Department of Soil Science, University of the Philippines Los Baños, College, Laguna 4031, Philippines

Rice bran is an agricultural waste or by-product which may have a potential in the food industry because of its nutritional value. It is rich in vitamins and minerals and is an excellent source of dietary fiber. However, the use of rice bran in food is limited by the rapid development of rancidity in bran after milling. Rice bran also contains a high level of phytic acid which is an anti-nutrient because it complexes with minerals. This study addresses these limitations using rice bran in food.

Our study established the conditions needed to effectively remove the phytic acid (dephytinization) from rice bran so that it will not turn rancid with minimal losses in nutrients and dietary fiber. We found that soaking the rice bran in water under ordinary conditions for 8 hours reduced phytic acid by 72% with little losses in minerals and dietary fiber. The bran was stabilized by steaming followed by drying. This can prevent development of rancidity and microbial growth even up to 7 weeks under ordinary conditions of storage.

We successfully incorporated about 25% rice bran in baked products like cookies, biscuits and brownies which are acceptable in terms of color, flavor, aroma and texture. Rice bran-containing baked food products are rich in crude and dietary fiber, fat, phosphorus, iron, thiamin, riboflavin and niacin. They are also cheaper than their counterpart full-wheat food products.

C. Scientific Paper

DEVELOPMENT OF FOOD PRODUCTS FROM DEPHYTINIZED
AND STABILIZED RICE BRAN

WILMA A. HURTADA[1] and MA. ANGELINE B. COSICO[2]

PROF. MABINI DG DIZON
LECTURER, ENG 10 C and T

[1]Associate Professor, Institute of Human Nutrition and Food, College of Human Ecology, University of the Philippines Los Baños, College, Laguna 4031, Philippines (Corresponding author; e-mail: wilmahurtada@yahoo.com)

[2]University Research Associate, Department of Soil Science, University of the Philippines Los Baños, College, Laguna 4031, Philippines

The possibility of improving mineral availability in rice bran and incorporating the bran in food products as potential source of fiber and other nutrients was investigated. Soaking in water at room temperature (RT) for 8 h and in water adjusted to pH 5.1 for 1 h both removed high amounts of phytate (72% and 63%, respectively) while steaming first for 1 h reduced phytate by 37% only. The former method had retained more nutrients in the bran and was considered as the best method among the three.

Stabilization by heat treatment was applied to prevent development of rancidity in rice bran. There was an increase in microbial count, free fatty acids and peroxide in the untreaterd bran while none or only a slight increase was observed in the treated bran after7 wk of storage.

Three types of food products were prepared with rice bran substituting for wheat flour at different levels: 25% and 50% levels of rice bran in biscuits and brownies and up to 75% in chocolate cookies. Sensory evaluation showed 25% substitution as the most acceptable level of rice bran in all food products. Rice bran (25%) contained more crude fiber and dietary fiber, fat, ash, phosphorous, iron, thiamin and riboflavin but had lower calorie, protein, calcium and carbohydrates than the purely wheat-based food products. Partial substitution of wheat flour with rice bran also reduced cost of production of the resulting food products.

Key words: dephytinization, stabilization, phytate, rice bran or “darak”, rancidity

Abbreviations: FA – free fatty acid, PV – peroxide value, RB – rice bran, RT – room temperature

INTRODUCTION

Rice bran or *darak* is the outer layer, including the germ that is removed during the first stage of milling dehusked rice to produce the white grain (Muro 1977; Caroll 1990). It is dark tan, unlike the polish (Staub 1982). Its potential as nutritious food ingredients is of particular interest. Rice bran as reported to have high-class protein (Pillaiyar 1981), to be richer in fat content than either wheat flour or rice (Orosa-del Rosario 1970) and other cereal brans particularly wheat and rye brans (Juliano 1993), to be rich in insoluble dietary fiber particularly cellulose and hemicellulose and to contain a fair amount of starch. It is an excellent source of B-vitamins, vitamin E (α-tocopherol) and phosphorous.

Rice bran is not usually part of the human diet because it rapidly becomes rancid, and has an anti-nutritional factor, phytate. Of all anti-nutritional factors, the phytic acid in rice bran is higher than in wheat bran, corn bran, soy bran and oat hulls (Tangendjaja et al. 1981; Ravindran et al. 1994). Thus, if rice bran is to be tapped as a food ingredient, its disadvantages must be reduced if not eliminated.

Phytate binds minerals in the gastrointestinal tract, making dietary minerals unavailable for absorption and utilization for absorption and utilization by the body (Graf and Eaton 1984). Its phosphate groups can readily form insoluble complexes with cations such as calcium, zinc, iron and magnesium, rendering them biologically unavailable. In addition, phytate can form complexes with proteins, making them less soluble and more resistant to proteolytic digestion (Luh et al. 1991).

During storage, hydrolytic and oxidative rancidity in the bran may occur. Lipase, among its many enzymes, promotes hydrolytic rancidity, resulting in the hydrolysis of the bran oil into glycerol and free

fatty acids (FFA). Peroxides can cause oxidative spoilage of bran components such as tocopherol and oil even at low moisture levels (Luh et al. 1991; Caroll 1990).

With the aid of pre-preparation treatments done on rice bran such as dephytinization and stabilization, it would now be possible to maximize its use by incorporating it in food products. The best application may be its incorporation in baked goods as these are more popular among the young and old alike. By incorporating rice bran in baked goods, it will easily gain wide public acceptance as food.

This study aimed to establish the potential of rice bran as nutritious human food source, particularly as a substitute for wheat flour in some baked products by determining the physico-chemical properties of food products dephytinized and stabilized rice bran. The study specially compared three methods I reducing phytate acid in rice bran, determined the keeping quality of rice bran after stabilization, and established the acceptability and nutritive value of food products with dephytinized and stabilized rice bran.

MATERIALS AND METHODS

Raw Material

Rice grains of the variety 'Bordagol' were obtained from the Philippine Rice Research Institute (PhilRice), through its branch office at the University of the Philippines Los Baños (UPLB), in Los Baños, Laguna. The grains were milled at the Agricultural and Bio-Process Division, College of Engineering and Agro-Industrial Technology (CEAT), UPLB. The rice bran was brought to the Bio-Assay Laboratory, College of Human Ecology, UPLB for treatments and analysis.

Dephytinization

Three treatments to remove phytic acid were conducted. In treatment 1 (steaming), raw rice bran samples were steamed for 1 h (Tangendjaja et al. 1981). Treatment 2 (soaking) involved soaking in distilled water at room temperature for 8 h (Reddy and Salunkhe 1980). In treatment 3 (soaking in pH adjusted water), rice bran was soaked in water adjusted to pH 5.1 (using acetate) at 55 C for 1 h (Sandberg 1991). The method that reduced phytate levels without causing much reduction in nutrient content was the treatment used for storage studies and food product development.

Stabilization

After phytic acid removal, rice bran was stabilized using moist heat method which involved steaming for 30 min, drying up to 3% moisture content at 105 C, then cooling (Valdez and de la Cruz 1985).

Storage Studies

Dephytinized and stabilized rice bran samples were packed in polyethylene bags and stored for 7 wk at room temperature.

Free fatty acid number (FFA No.) and peroxide value (PV) of the samples were determined every week to monitor the development of rancidity during storage (AOAC 1990). Likewise, total plate count and mold count were determined to measure microbial load during storage following FDA (1978) standard procedures.

Phytic Acid, Total Dietary Fiber and B-Vitamin Analysis

Phytic acid and total dietary fiber contents of the untreated (raw) and treated (dephytinized and stabilized) rice bran were analyzed following the AOAC (1990) procedures. Thiamin, niacin and riboflavin were analyzed following the procedures of the Food Development Center, FTI Compex, Taguig, Metro Manila.

All analyses were done in triplicates except for phytate analysis where six trials were made.

Incorporation of Rice Bran in Baked Products

Preliminary sensory evaluation test showed that incorporation of 100% rice bran resulted in extremely unacceptable products. Rice bran was then incorporated in biscuits and brownies at 25% and 50% levels substitution, respectively. In chocolate chip cookies, rice bran was substituted for heat flour up to 75%. These food products were subjected to sensory evaluation to determine the degree of acceptability of each.

The nutritive value of rice bran products was determined using the Food Composition Table (FCT) (FNRI 1997). Values for all ingredients were obtained from the FCT except for rice bran, which was based on the results of the chemical analyses in the study. Values for wheat flour were computed based on the values obtained from Lineback and Rasper (1988).

Sensory Evaluation. Randomly selected students from UPLB constituted the panel to evaluate the acceptability of the products (Mabesa 1986; Gatchalian 1989). The samples served included the control plus the experimental products.

Statistical Analysis

Completely Randomized Design was used in determining the variation in chemical composition among treatments. For storage studies, repeated measure were used. Data from chemical and sensory analyses were subjected to Analysis of Variance (ANOVA) using the F-test to evaluate treatment effects. Duncan's Multiple Range Test (DMRT) was also employed to locate significant differences among treatments, if any. Pearson Correlation Analysis was also used to test whether a significant linear correlation existed between variables from sensory evaluation data.

RESULTS AND DISCUSSION

Dephytinization

Soaking at RT for 8 h resulted in 72% reduction of phytate in rice bran while soaking at pH 5.1 for 1 h reduced phytate by 63.4%, which was not significantly different from the former. On the other hand, steaming reduced phytate by only 37% for 1 h (Fig. 1). Soaking can activate phytase, which in turn, hydrolyzes phytate (inositol hexaphosphate) to inositol and orthophosphate via inositol penta-to monophosphates as intermediary products (Sanberg 1991). Phytate reduction was effective at pH 4.4 to 5.5 due to the increased activity of

*Means with the same letter are not significantly different at 5% level (DMRT)
Fig. 1. Phytate content of rice bran samples subjected to different treatments.

endogenous phytase at this pH range (Sandberg 1991; Tangendjaja et al. 1981). The high temperature during steaming, i.e. 120-125 C, could have partially degraded the enzyme phytase during the early stages of steaming and inactivated at about 70 C, thus, resulting in the low phytate reduction in steamed bran (Sandberg 1991; Tangendjaja et al. 1981; Reddy and Salunkhe 1980).

The removal of phosphate groups from phytate reduces its mineral-binding capacity (Yoshida et al. 1975), implying that more minerals are made available for utilization by the body. Treatment should, however, preserve the nutrients in rice bran.

B-Vitamin and Fiber Contents of Treated and Untreated Rice Bran

B-Vitamins. Steamed rice bran retained the highest amount of thiamin and niacin (0.38 mg per 100 g and 30.85 mg per 100 g, respectively) while bran soaked in water of pH 5.1 had the highest riboflavin. Changes in riboflavin content in treated samples ranged from 0% to 20% although these were not significantly different from each other. Steaming of rice bran resulted 32% thiamin loss compared to higher losses in soaked bran (46% to 73%). Loss in niacin followed the same trend as in loss in thiamin. Rice bran soaked in distilled water, however, retained high (second to the highest) amounts of thiamin, riboflavin and niacin (Fig. 2).

a
b
c

*Means with the same letter are not significantly different at 5% level (DMRT)

Fig. 2. Effect of dephytinization and stabilization on the thiamin (a), riboflavin (b) and niacin (c) contents of rice bran.

Steaming results in better retention of water-soluble vitamins than soaking or boiling (De Ritter 1982). For soaked bran, thiamin loss is greater because soaking and heat treatments contributed to its degradation. Riboflavin has been found to be stable to heat (Rosenberg 1945; Lee 1958; Khalil and Mansour 1995) and acid pH but unstable in alkaline solution (De Ritter 1982). Niacin is also stable in air and light and over a normal pH range of food products (De Ritter 1982).

Based on the results presented, soaking in distilled water is considered the best among the three treatments. It was able to reduce high amounts of phytate with minimal effect on the B-vitamin content. This treatment was used in the storage studies and in the development of food products.

Crude and Dietary Fiber. Treating rice bran significantly increased its crude fiber content from 1.04% to 3.92% but not its dietary fiber content, i.e., ranging from 28.98% to 31.65% (Fig. 3). Cellulose, lignins and pentosans, which make up the fiber content of foods, are generally stable to heat treatment, unhydrolyzed by acids, bases and the human digestive system (Montgomery et al. 1983). The higher crude fiber content in all treated samples compared to that of the control may be the result of the soaking, steaming and stabilization processes, which could have softened the cell walls or other plant tissues, thus, making the substrate more available for extraction during the analysis.

Rancidity and Microbial Counts During Storage

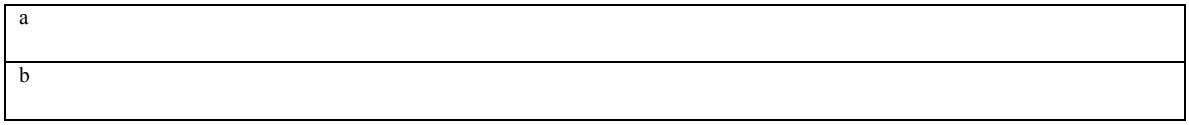
A gradual increase in free fatty acid (FFA) number and peroxide value (PV) was observed in the untreated bran during storage but not in the treated bran (Fig. 4 and 5).

Only a minimal amount of peroxides was formed during the 7-wk storage period and the values obtained were below 20 meq kg^{-1}, implying that the formed peroxides could not cause rancidity. Although peroxidase causes oxidative spoilage of bran components at low moisture levels (Martin 1993; Luh et al. 1991), Yamatsu et al. (1966) and Moritaka et al. (1972) noted that unsaturated fatty acids do not undergo oxidation during storage as indicated by their uniform fatty acid composition and content, thus resulting in low peroxide formation.

There was also a significant increase in the microbial counts in the untreated bran especially during the last week of storage but a lower increase in microbial counts was observed in the treated bran (Fig. 6 and 7). High moisture content in the untreated bran permitted mold growth, which produced active lipases promoting the hydrolysis of bran oil into glycerol and FFA. This explains the increase in FFA number.

Based on the results, steaming then drying, was effective in preventing or slowing down the growth of spoilage microorganisms, resulting in slight or no increase in FFA number. Also, steaming

inactivates lipases and thus, development of hydrolytic rancidity is prevented (Rhee et al. 1975; Muro 1977).

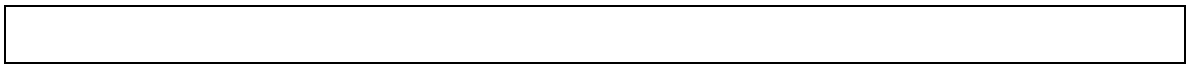


*Means with the same letter are not significantly different at 5% level (DMRT).

Fig. 3. Effect of dephytinization and stabilization on the dietary (a) and crude (b) fiber contents of rice bran.

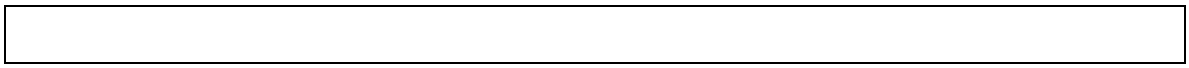
*Means with the same letters within and between lines are not significantly different at 5% level (DMRT).

Fig. 4. Free fatty acid number (FFA No.) of treated and untreated rice bran during storage.



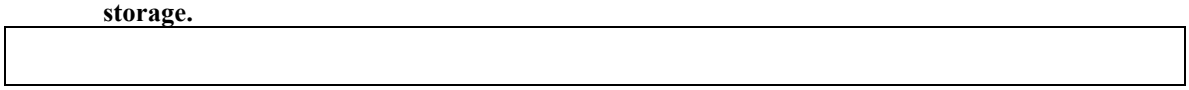
*Means with the same letters within and between lines are not significantly different at 5% level (DMRT).

Fig. 5. Peroxide value (meq kg^{-1}) of treated and untreated rice bran during storage.



*Means with the same letters within and between lines are not significantly different at 5% level (DMRT).

Fig. 6. Total count of viable microorganisms (cfu mL^{-1}) of treated and untreated rice bran during storage.



*Means with the same letters within and between lines are not significantly different at 5% level (DMRT).

Fig. 7. Mold count of treated and untreated rice bran during storage.

Table 1. Chemical composition of rice bran before and after storage for 7 wk.

Nutrients	Storage*		
	Before	After	% Loss
Fat (%)	14.00a	14.29a	2.07
Protein (%)	10.71a	10.29a	3.92
Crude fiber (%)	13.18a	13.00a	1.36
Dietary fiber (%)	31.65a	31.00a	2.05
Ash (%)	14.10a	14.20a	0.70
Calcium (mg per 100g)	37.62a	37.40a	0.58
Phosphorus (mg per 100g)	213.37a	208.00a	2.51
Iron (mg per 100g)	14.76a	15.02a	1.76
Thiamin (mg per 100g)	0.3a	0.21b	30.00
Riboflavin (mg per 100g)	0.2a	0.24b	14.28
Niacin (mg per 100g)	30.66a	22.7b	25.96

*Means in a row followed by a common letter are not significantly different at 5% (DMRT).

Nutrient Content of Treated and Untreated Rice Bran After Storage

Although most of the nutrients of rice bran remained the same, thiamin, niacin and riboflavin were reduced by about 30%, 26% and 14%, respectively (Table 1). Increasing the moisture content (attributed to hygroscopicity) in rice flakes stored in aluminum pouch and laminates at ambient temperature favored destruction of thiamin (Hurtada and Raymundo 1995). The same could have happened to riboflavin and niacin which are also water-soluble. Kneifel (1989) and Harris and Lavenberg (1960) classified niacin as stable (12% to 14% loss) under different storage conditions. Losses in riboflavin and niacin contents could also be attributed to their apparent sparing action on thiamin degradation.

Incorporation of Rice Bran into Food Products

Chocolate Chip Cookies. Although cookies were still acceptable at 50% substitution, cookie samples substituted with 25% rice bran had significantly better acceptability scores. The decline in acceptability of cookies as bran substitution was increased may be due to the resulting increase in gritty texture, intensity of dark color and prominence of the aroma or flavor of rice bran in the cookies, according to the panelists. Mean scores were high for all samples, implying the masking effect of choco chips in the cookies (Table 2). Correlation analysis of the products showed that the high overall acceptability of 25% rice bran cookies was based on color, texture, and flavor, indicating that an increase in rice bran content effects the acceptability of these characteristics.

Table 2. Mean scores for acceptability of cookies, biscuits and brownies with or without rice bran.*

Characteristics	Mean Acceptability Score**									
	Cookies				Biscuits			Brownies		
	Control	25%	50%	75%	Control	25%	50%	Control	25%	50%
Color	4.60a	4.40a	3.83b	3.27c	4.73a	3.16b	2.20c	4.00a	4.40a	4.32a
Aroma	4.60a	4.30a	3.97a	3.83b	4.53a	4.10b	3.37c	4.44a	4.44a	4.28a
Texture	4.47a	4.03ab	3.73b	3.53b	4.31a	3.35b	2.88c	4.20a	4.08a	3.64a
Flavor	4.27a	4.07a	3.90a	3.97a	4.43a	3.37b	2.28c	3.92a	4.36a	3.88a
Gen. Acceptability	4.53a	4.10b	3.90bc	3.67c	4.41a	3.49b	2.45c	3.96a	4.28a	3.92a

*Means in a row followed by a common letter are not significantly different at 5% (DMRT)
**Rating Scale: 5.0 – extremely acceptable; 1.0 – extremely unacceptable

Biscuits. Mean acceptability scores of the rice biscuits substituted with 25% rice bran were higher than those of the biscuits substituted with 50% rice bran. Acceptability of color, aroma, texture and flavor of the biscuits declined as the amount of rice bran was increased (Table 2). Rice bran, with its characteristic color, aroma, texture and flavor, has the power to change the properties of regular biscuits. Panelists chose biscuits that were light brown, with finer texture, and with less rice bran aroma. As substitution of flour with rice bran was increased, the panelist complained about the darkening in color, the husky texture and the smell of "animal feed" in the biscuits. The study also showed that consumers tended to choose a product based on its appeal rather than its nutritional value.

Brownies. Mean scores for aroma, texture, color, flavor and general acceptability of rice bran brownies did not decline significantly with increase in percentage substitution (Table 2). All of the rice bran brownies were highly acceptable to the panelists in all the criteria mentioned. This is because chocolate complements the sweet and nutty flavor of rice bran (Luh et al. 1991; Caroll 1990), and rice bran does not have any aftertaste unlike wheat bran, or bran from other sources (Caroll 1990). However, 25% substitution was more preferable because based on the comments of the panelists, 'fibrous matter' could be detected in the samples with 50% level substitution, causing an unpleasant sensation.

Nutrient Content of Food Products with Rice Bran

Table 3 summarizes the nutrient contents per serving of food products with or without 25% rice bran. Incorporation of rice bran increased the amount of crude and dietary fiber, fat, ash, phosphorus, iron, thiamin, riboflavin and niacin contents in all the food products. However,

Food Products	Energy (Kcal)	Protein (g)	Fat (g)	CHO (g)	Crude fiber (g)	Dietary fiber (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Thiamin (g)	Riboflavin (g)	Niacin (g)
Biscuits (control)**	85	2.8	1.5	15.1	0.6	0.5	0.3	46	35	0.8	0.01	0.05	0.9
Biscuits with 25% RB**	83	2.7	2.0	14.5	1.0	1.9	0.8	44	40	1.2	0.02	0.06	2.0
Choco chip cookies (control)**	385	11.2	20.2	54.3	1.0	0.9	2.2	119	258	6.6	0.22	0.12	1.6
Choco chip with 25% RB cookies **	382	11.1	21.2	53.3	1.8	2.1	3.3	116	266	7.4	0.24	0.11	3.5
Brownies (control)**	141	4.0	3.7	25.5	0.6	0.6	0.5	34	63	1.7	0.04	0.05	1.1
Brownies with 25% RB**	139	3.9	4.3	24.8	1.1	2.1	1.1	32	68	2.2	0.05	0.05	2.3

Table 3. Nutrient content per serving* of food products without and with 25% rice bran (RB)
*Choco chip cookies: yield=24 pcs; 3 pcs per serving. *Brownies: yield=25 pcs; 1 pc per serving. *Biscuits: yield=70 pcs; 5 pcs per serving
**Computations for all ingredients were based on the Food Composition Table (FCT) except for rice bran which was based on analyses done in the study; computations for wheat flour based on value obtained from wheat.

the products had lower calorie, protein, calcium and carbohydrate contents compared to the control. It can be noted that rice bran contributes high amounts of crude and dietary fiber in the formulated food products. Fiber is known to act as a laxative reducing transit time. It also modifies rate of absorption of nutrients by delaying the entry of food into the intestine, an effect beneficial to diabetes mellitus patients. High-fiber diets have been reported to be beneficial for individuals with hypercholesterolemia, diverticulosis, diabetes mellitus, obesity and colorectal cancer (Yetiv 1988; Saunders 1986; Salverdran et al. 1987).

Cost of Production

Incorporation of rice bran reduced the cost of production of biscuits, brownies and chocolate chip cookies (Table 4). Since nutrient deficiency is linked to income structure, ways and means must be found to produce low cost food from local resources (Marquez 1993). It was shown in this study that a partial substitution of wheat flour with rice bran reduced the cost of some baked products and that on a commercial scale, it can help reduce the dollar requirements for importation of wheat flour.

CONCLUSION AND RECOMMENDATION

Food products developed from dephytinized and stabiolized rice bran were found to be nutritious, cheaper, have longer shelf life and have better sensory qualities than food products without bran.

Soaking in water at RT for 8h, soaking in pH 5.1 for 1 h and steaming resulted in 72%, 63.4% and 37% reduction, respectively, in the phytate content of rice bran, implying that the former was the more effective method in phytate reduction as well as in the retention of the B vitamins. Steaming, followed by drying of the dephytinized rice bran, resulted in lower microbial and mold counts so that the bran could be stored longer at room temperature.

Table 4. Production cost of food products with or without (25%) rice bran.

Food Product	Cost	
	Per piece	Per serving
Chocolate chip cookies	0.944	P7.55/3 pieces
25% RB choco chip cookies	0.90	7.16/3 pieces
Biscuits	0.49	2.45/5 pieces
25% RB Biscuits	0.44	2.20/5 pieces
Brownies	1.60	1.60/ piece
25% RB Brownies	1.50	1.50/ piece

No sign of rancidity was observed as indicated by low FFA number and low PV during the 7-wk storage period.

Increasing the amount of rice bran in cookies, biscuits and brownies resulted in decreased acceptability due to detection of fibrous matter which caused irritation when swallowed, darkening in color and smell of animal feed. Substituting rice bran for wheat flour in some baked products up to 25% increased the amount of dietary fiber, fat, ash, iron, thiamin, riboflavin and niacin but showed lower calorie, protein, calcium and carbohydrates contents. They were also liked better for aroma, color, texture and flavor. The products are not only nutritious but had lower production cost. Thus, rice bran is a potential substitute for wheat flouyr in some baked products.

It is recommended that studies on incorporation of rice bran in other types of food be conducted. Further studies on other vitamins and minerals, i.e., vitamin E (α-tocopherol) and zinc, as well as studies regarding spore count, actual shelf life in different packages, and storage conditions are still needed.

ACKNOWLEDGMENT

We thank the Institute of Human Nutrition and Food, College of Human Ecology of UPLB for the use of its Bio-Assay Analytical Laboratory for the conduct of some of the chemical analyses and the Food and Nutrition Laboratories for the sensory evaluation tests.

REFERENCES CITED
(Note: The authors followed the style as prescribed by the Journal.)

AOAC [ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTRY]. 1990. Official Method of Analysis, 15th ed. Washington, D.C: Association of Official Analytical Chemists, Inc. 684 p.

CARROL LE. 1990. Functional properties and applications of stabilized rice bran in bakery products. Food Technology 44(4):74-76.

DE RITTER E. 1982. Effects of processing on nutrient content of food: vitamins. In: Rechcigl M, editor. Handbook of Nutritive Value of Processed Foods, Vol. 1. Florida: CRC Press. p.471-473.

FDA [FOOD AND DRUG ADMINISTRATION]. 1978. Bacteriological Analytical Manual. 5th ed. Bureau of Foods, Division of Microbiology. 576 p.

FNRI [FOOD AND NUTRITION RESEARCH INSTITUTE]. 1997. Food Composition Table. Bicutan, Taguig, Metro Manila, Philippines: Department of Science and Technology, 163 p.

GATCHALIAN M. 1989. Sensory Evaluation Techniques. Quezon City, Philippines: Department of Home Technology, College of Home Economics, University of the Philippines Diliman. 471 p.

GRAFT E, EATON JW. 1984. Effects of phyrate on mineral bioavailability of mice. J Nutr 114:1192-1198.

HARRIS RS, LEVENBERG RK. 1960. Effect of home preparation on nutrient content of foods of plant origin. In: Harris RS, Von Loeseche H, editors. Nutritional Evaluation of Food Processing. New York: J Wiley Sons, Inc. p. 452-491.

HURTADA WA, RAYMUNDO LC. 1998. Processing, packaging and storage stability of pinipig (rice flakes). Philipp Agric 80(1 & 2): 65-86.

JULIANO BO. 1993. Rice in Human Nutrition. Rome: FAO. 162 p.

KHALIL AH, MANSOUR EH. 1995. The effect of cooking, autoclaving and germination on the nutritional quality of faba beans. Food Chem 54(2):177-182.

KNEIFEL W. 1989. Storage stability of full-fat milk powder with reference to vitamin content. I. Physico chemical parameters and results of shelf-life studies. Milchwissenschaft 44(10):607-611.

LEE FA. 1958. The blanching process. Adv Food Res 8:63-109.

LINEBACK DR, RASPER VF. 1988. Wheat carbohydrates. In: Pomeranz Y, editor. Wheat: Chemistry and Technology. USA: Washington State University. p. 325.

LUH BS, BARBER S, de BARBER CB. 1991. Rice Bran: Chemistry and Technology. In: Luh BS, editor. Rice Utilization. New York: Van Nostrand Reinhold. p. 313-357.

MABESA LB. 1986. Sensory Evaluation of Foods: Principles and Methods. College, Laguna, Philippines: University of the Philippines at Los Baños. 122 p.

VI. GUIDELINES FOR PREPARATION OF POSTER PAPERS

A. General

A **Poster** is a method of communicating an idea, message or instruction to a mainly mobile audience, a visual combination of bold design, color and message which is intended to catch and hold the attention of passersby long enough to implant a specific impression.

Qualities of an effective poster presentation:

1. focuses on one main idea/message
2. forceful and clear in treatment
3. conveys the idea fast and direct through vivid visual image
4. uses bold colors that catch attention and focuses on the message
5. large and simple enough to be seen and understood at a brief glance.

Tips in designing posters

1. use concise and straight to the point slogan or verbal message
2. make letterings or text clear, large and evenly spaced
3. make your illustrations using bold shapes and outlines to have more impact
4. always aim for simplicity
5. make your layout dynamic to direct your viewer's attention
6. make sure that the different elements complement each other to create a pleasing effect
7. use color to focus the main idea or message
8. make color combination attractive and appealing

Three basic components/elements of poster presentation

1. graphic or pictorial element
2. text or word element
3. background or silence

Format in poster presentation

1. Your poster should be the size of one illustration board, vertical format (i.e. narrower width and longer length/height).
2. Present only the highlights/conclusion/important data of your project.
3. Have enough visuals and only a minimum of text, posters are visual, not verbal media
4. Use illustrations, charts, graphs and other visuals and letterings that are large enough to be seen and read.

B. Specific Format used by the National Academy of Science and Technology (NAST)

A **poster** should be attractive, well organized, self-explanatory and should present a few major ideas. Do not overwhelm the audience with data or explanations. The discussion should give the interpretation and significance of the results. Try to give the viewer one or two important conclusion from your study. The following specific points may help you in the preparation:

1. **Size.** The whole poster should fit into a standard 30" x 40" (76 cm x 102 cm) poster board.

2. **Title.** Make the title maximum of 10 words. Use letters equivalent to 72 points (about 2 cm) for the main title and 40 points (less than 1 cm) for subtitle and author/s.

3. **Text Lettering.** Use type letters that are at least 20 points (about 6 mm) high. In typesetting the test, choose a sans serif (simple) typeface. Use upper and lower case standard letters. Be sure to use new printer ribbon if you do not have laser or inkjet printer.

4. **Text**. Give a brief (50 words) introduction stating the purpose of the study. Minimize words while maximizing visuals. End with a brief conclusion (40 words).

5. **Colors.** Use no more than three colors. Good tow-color combination are black on white, black on yellow, black on pink, dark red on white, dark blue on white, and dark blue on yellow. Dark type on a light background is easiest to read.

6. **Illustrations.** Photographs and graphs should be 5" x 7" (12.5 cm x 18 cm). Captions and labels on diagrams should be readable from two meters away, and not cluttered with unnecessary detail. Diagrams and graphs should have no more than six lines in contrasting colors. Use only one vertical scale per graph. Graphs are preferable to tables.

7. **Organization.** The design should flow sequentially from one part to the next. Numbers or arrows may be used to help the eye move from item to item in the correct order, left to right, top to bottom. Do not clutter with either test or artwork.

VII. PRESENTATION FORMATS FOR THE THESIS, SPECIAL PROBLEM, AND PRACTICUM REPORTS

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II. SPECIAL PROBLEM

PROF. MABINI DG DIZON
LECTURER, ENG 10 C and T

Title
Author and Adviser

Abstract

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C. Significance of the problem

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(Can be divided into major and minor operations)

MANAGEMENT OF PERSONNEL
(Can be classified into executive, administrative; recruitment of personnel; labor requirements; working days, salaries, etc.)

PROF. MABINI DG DIZON
LECTURER, ENG 10 C and T

ACTIVITIES PARTICIPATED IN BY THE PRACTICUMER
(May include pictures as proofs)

COMMENTS/SUGGESTIONS/RECOMMENDATIONS
(May focus on the company itself or on the conduct of the practicum)

SUMMARY AND CONCLUSION
(May include learnings and realizations of the practicum experience)