

Application of Modified Atmosphere Packaging (MAP)

to Extend Shelf Life of Bamboo Shoots

(Dendrocalamus asper);

Effects of Packaging and Storage Temperature

By : MARIA LUSIANI

NIM : 98.70.0097


NIRM : 98.6.111.22050.50026

**This thesis has been approved and defended in front of
the examination committee on : July 7, 2003**

Semarang, 2003


**Faculty of Agricultural Technology
Soegijapranata Catholic University**

Supervisor I

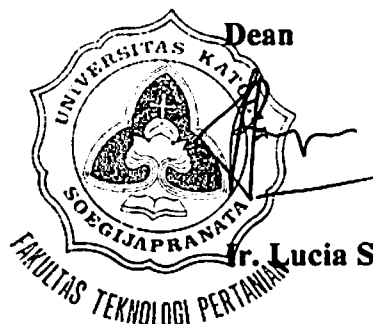


Dr. Stefan Persijn

Supervisor II

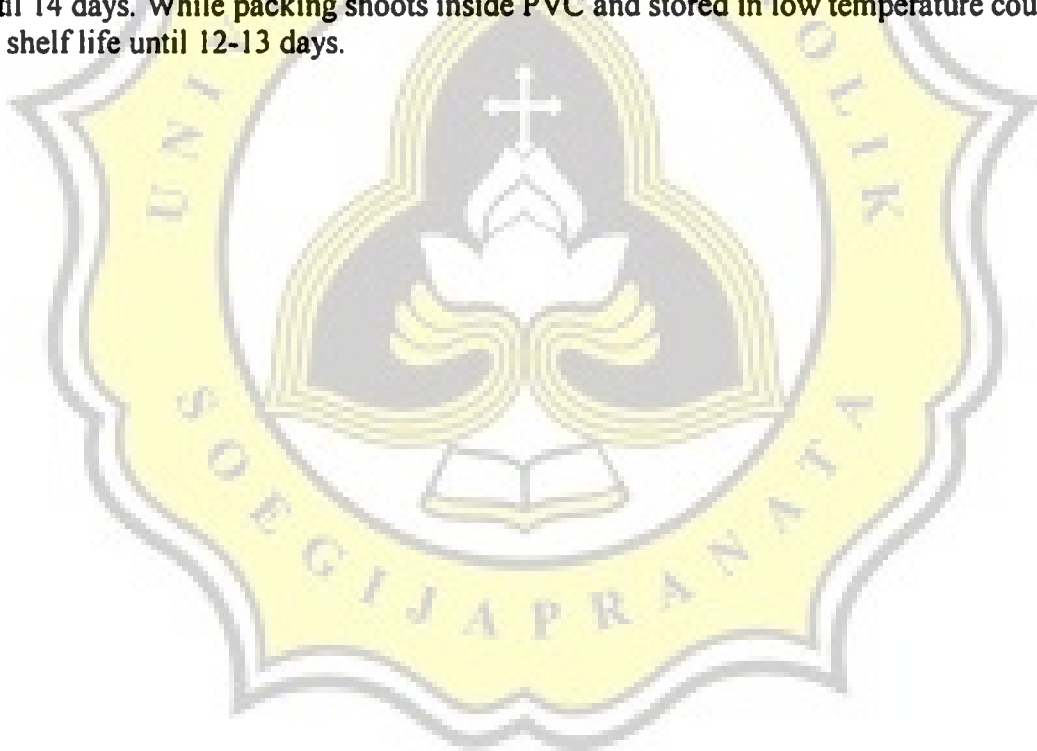


R. Probo Yulianto N., STP



SUMMARY

Quality of bamboo shoots “petung” (*Dendrocalamus asper*) decreases rapidly after harvest, its shelf life is only 1 day. That is caused by the high respiration and transpiration rate. In this study we applied MAP in combination with low temperature storage to bamboo shoots in order to extend their shelf life. Two kinds of packaging materials (PVC wraps and PP bags) were used and unpacked samples acted as control. Shoots were stored at room temperature ($\pm 29^{\circ}\text{C}$) or in the refrigerator ($\pm 10^{\circ}\text{C}$). The analysis of shoots included respiration, transpiration, weight loss, discoloration and fungal contamination. It was observed that the average weight loss of unpacked samples is more than 5% per day, while average weight loss of shoots packed in plastic is less than 1% per day. Discoloration and fungal contamination were more severe of shoots stored in room temperature than refrigerated samples. Low temperature gives extended shelf life till 2 days. Combining plastic with low temperature was most effective to extend shelf life of bamboo shoots. PP bag is more effective than PVC wrap to extend shelf life of shoots; packaging shoots in PP stored in low temperature could extend shelf life until 14 days. While packing shoots inside PVC and stored in low temperature could extend shelf life until 12-13 days.



RINGKASAN

Kualitas rebung petung (*Dendrocalamus asper*) menurun secara cepat setelah dipanen, umur simpannya hanya bertahan sampai 1 hari. Hal ini disebabkan oleh karena proses respirasi dan transpirasi masih berlangsung setelah dipanen. Dalam penelitian ini digunakan MAP yang dikombinasi dengan penyimpanan pada suhu rendah untuk memperpanjang umur simpan rebung. Dua jenis plastik (wrap PVC dan kantong PP) yang digunakan dan sampel yang tidak dikemas sebagai control. Selanjutnya, rebung tersebut disimpan dalam suhu kamar ($\pm 29^{\circ}\text{C}$) dan almari pendingin ($\pm 10^{\circ}\text{C}$). Analisa yang dilakukan meliputi respirasi, transpirasi, kehilangan berat, perubahan warna, dan kontaminasi jamur. Dari hasil penelitian, diketahui bahwa rata-rata kehilangan berat dari sampel yang tidak dikemas (kontrol) adalah lebih dari 5% per hari, sedangkan rata-rata kehilangan berat pada rebung yang dikemas dalam plastik adalah kurang dari 1% per hari. Perubahan warna dan kontaminasi jamur terlihat jelas pada rebung yang disimpan dalam suhu kamar. Penggunaan suhu rendah dapat sedikit meningkatkan umur simpan rebung hingga 2 hari. Kombinasi plastik dengan suhu rendah dapat memperpanjang umur simpan rebung. Plastik jenis kantong PP lebih efektif daripada wrap PVC untuk memperpanjang umur simpan rebung; Rebung yang dikemas dalam PP disimpan dalam suhu yang rendah dapat memperpanjang umur simpannya hingga 14 hari. Sementara, rebung yang dikemas dalam PVC wrap dan disimpan dalam suhu yang rendah dapat memperpanjang umur simpannya hingga 12-13 hari.



PREFACE

Thanks to God, only this is what I can say for his blessing to me. I am very thankful to Dr. Stefan Persijn, as my supervisor I and R. Probo Yulianto N., STP, as my supervisor II for their help since I began my research until I finished my report. I also would like to acknowledge all lecturers of the Department of Food Technology. Ir. Lucia Sri Lestari, MSc., as the dean of FTP, Ir. Soedarini, MP., as my former dean and “dosen wali” and Ir. Christina Retnaningsih, MP., as my first and current “dosen wali”.

I am grateful to my whole family for always helping and praying for me, so that my thesis is finished. Thanks to Mr. Budi, Mr. Surat, Yohanes, Hengtono and Mr. Pri who helped me to find bamboo shoots. Budi, Edwin, Abdiel, Asih, Andriani, and my friends in “Joyful Family”, they always encourage and pray for me. Also, I would like to thank all “Angkatan’98”, Fendy and Abelin (Angkatan’99), Mario, A Kian, Mr. Soleh and Ms. Wiwik.

I also thank all parties who helped me with this work and who I cannot mention here. I am nothing without all of you. God bless you all.

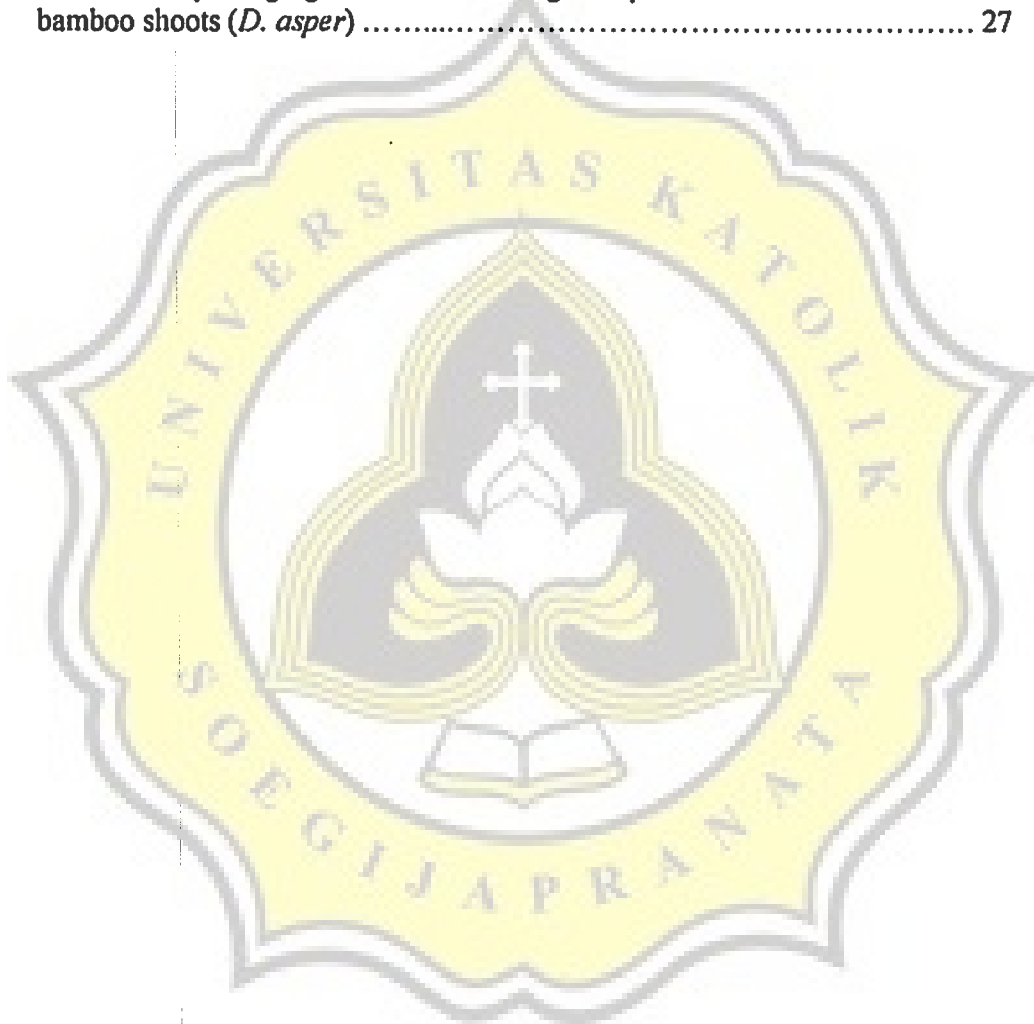
Maria Lusiani

LIST OF CONTENTS

	Page
SUMMARY	i
RINGKASAN	ii
PREFACE	iii
LIST OF CONTENTS	iv
LIST OF TABLES	v
LIST OF FIGURES	vi
LIST OF APPENDICES	vii
1. INTRODUCTION	1
1.1. Bamboo Shoot	2
1.1.1. Botany of Bamboo Shoot	2
1.1.2. Use of Bamboo Shoot	3
1.1.3. Chemical Properties	3
1.2. Respiration	4
1.3. Storage in Modified Atmosphere Conditions.....	4
1.4. Storage by Cooling	6
1.5. Storage in Plastic Packaging	6
2. MATERIALS AND METHODS	9
2.1. Analysis of Respiration	10
2.2. Analysis of Weight Loss	10
2.3. Analysis of Discoloration	10
2.4. Quantitative Fungal Load	11
2.5. Determination Shelf Life	11
2.6. Data Analysis	11
3. RESULTS	12
3.1. Respiration and Gas Concentration Measurement	12
3.2. Transpiration	16
3.3. Weight Loss	17
3.4. Discoloration	18
3.5. Fungal Contamination	20
4. DISCUSSION	23
4.1. Respiration	23
4.2. Transpiration	24
4.3. Weight Loss	25
4.4. Discoloration	26
4.5. Fungal Contamination	26
5. CONCLUSIONS	28
6. REFERENCES	29
APPENDICES	

LIST OF TABLES

	Page
Table 1. Composition of bamboo shoot per 100 g of edible part	3
Table 2. Effect of O ₂ , CO ₂ and temperature on vegetable physiology	6
Table 3. Gas and water permeability of packaging films	7
Table 4. Influence of packaging material and storage temperature on shelf life of bamboo shoots (<i>D. asper</i>)	27



LIST OF FIGURES

	Page
Figure 1. <i>Dendrocalamus asper</i> species of bamboo shoot	2
Figure 2. Bamboo plants	9
Figure 3. Sample of shoots	9
Figure 4. Respiration measurement of unpacked bamboo shoot sample in a closed container	12
Figure 5. Oxygen consumption rate of unpacked bamboo shoots	13
Figure 6. Carbon dioxide production rate of unpacked bamboo shoots	13
Figure 7. Oxygen concentration measurement in PP plastic	14
Figure 8. Carbon dioxide concentration measurement in PP plastic	14
Figure 9. Oxygen concentration in plastic containing the bamboo shoots	15
Figure 10. Carbon dioxide concentration in plastic containing bamboo shoots	16
Figure 11. Transpiration measurement in a closed container	16
Figure 12. Transpiration rate of unpacked bamboo shoots	17
Figure 13. Relative weight loss of bamboo shoots stored in room temperature	17
Figure 14. Relative weight loss of bamboo shoots stored in refrigerator	18
Figure 15. Discoloration of bamboo shoots stored in room temperature	19
Figure 16. Discoloration of bamboo shoots stored in refrigerator	19
Figure 17. Photograph of discoloration of bamboo shoots	20
Figure 18. Fungal contamination of bamboo shoots stored in room temperature and refrigerator	21
Figure 19. Photograph of fungal contamination on bamboo shoots stored at room temperature	21
Figure 20. Photograph of fungal contamination on bamboo shoots stored at refrigerator	22

LIST OF APPENDICES

	Page
Appendix 1. The calculation of respiration rate, gas concentration and transpiration rate	32

