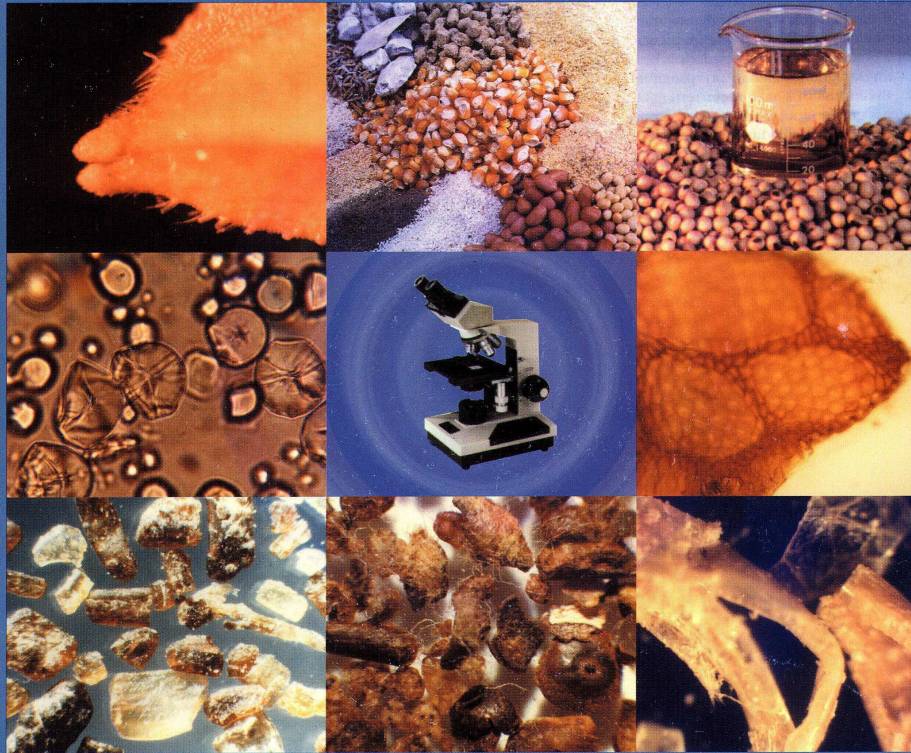


# MANUAL OF FEED MICROSCOPY AND QUALITY CONTROL

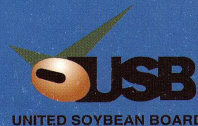
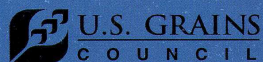
Third Edition, 1999



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In collaboration with  
AMERICAN SOYBEAN ASSOCIATION  
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## PREFACE

The first edition of this manual, published 12 years ago, appears to be very useful to those involved in feed compounding, farmers as well as the quality control staff of feed mills. Some 3,000 copies, including a Chinese translated version, have been distributed in many of Asian countries. Based on the guidelines given in the manual, feed quality training short courses and workshops have been organised by associations, feed mills and educational institutions. Yet, there are still demands for a more comprehensive manual emphasizing the characterization of feed ingredients commonly used in Asia.

Although the basic characteristics of most feed ingredients have not changed, the authors have included additional information missed or omitted from the earlier editions. New techniques have been developed to cope with the changes feed processing techniques; and newly developed spot tests for microingredients and feed additives have also been included in this edition. This manual is intended to be of value for new and experienced feed microscopists and quality control personnel in the region. However, the information included in this edition is not, by all means, complete. There is still room for enthusiastic feed microscopists to add information on the characteristics of Asian feed ingredients. We thus welcome comments and suggestions for further additions of this manual.

Several individuals have dedicated their valuable time, assistance and guidance for successful completion of this manual. We would like to express our thanks and gratitude for their valuable support.

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Third edition, 1999

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This book was set in Khon Kaen by Klang Nana Wittaya Co.Ltd., Khon Kaen, Thailand.

ISBN 974-676-334-2

Printed in Thailand.

American Soybean Association  
United States Grains Council  
May, 1999

## ACKNOWLEDGEMENT

The authors wish to express their gratitude to the following individuals and their organizations for the financial support in the publication of this manual and for their advice and encouragement:

Mr. John A. Lindblom of the American Soybean Association,  
Dr. Robert A. Swick of the American Soybean Association,  
Ms Dalilah DeLaine of the American Soybean Association,  
Mr. Cary Sifferath of the US Grains Council.

Publication of this manual would not have been possible without their support.

Sincere thanks are also extended to our colleagues at Khon Kaen University Animal Nutrition Laboratory for their tireless assistance in the preparation of specimens and production of photomicrographs. Special thanks are expressed to our graduate students, Narongchai Siriloaphaisarn and Sawitree Wongtangtintharn, for their assistance in preparation of the manuscript.

Moral support of our children, Dane, Duang and Dyan, is mostly appreciated.

S.& J. Khajarern  
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May, 1999

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## INTRODUCTION

Animal production industries as well as aquaculture play an increasingly important role in modern agriculture and contribute a substantially increasing portion of protein needed by the human population. Each year, more species are studied and cultured, more products and by-products are marketed. The related activities supporting the production, particularly in the formula feed industry, are expanding constantly to meet the needs. As animal feed accounts for as much as 60 to 70 percent of the total cost of production, the strong sustained growth of these industries will thus require an increasing amount of quality raw materials. In order to produce good quality feeds, the quality control of incoming feed ingredients and quality assurance of outgoing finished feeds are of primary importance. Diversity of ingredient sources, by-products and/or agricultural or industrial wastes, presents some unique problems in quality control. These problems include the inadequate descriptions of the ingredient meals, the similarities, the small particle size, the quality variation of individual ingredients, the decrease in quality from contaminants and adulterants, the blending of composite meal to lower the prices, the variation in methods of analysis used and so on.

Routinely, the quality of a feed ingredient is measured by a combination of chemical and physical characteristics. Chemical evaluations are objectively oriented toward the levels of nutrients and nutrient availability in the ingredient. Chemical evaluations give accurate and consistent results for most nutrients, but are time consuming. This can be critical for larger feed mills where decisions on rejection/acceptance of a feed ingredient must be made quickly in order to maintain a smooth flow of incoming ingredients in unloading areas and in the production lines.

Physical evaluations are more concerned with the source of nutrients, adulterants, contaminants or other visible characteristics. Microscopes, both stereo and compound types, and even the magnifying reading lens are commonly used in the physical evaluation of feed ingredients. Feed microscopy helps to determine if an ingredient meal is derived purely from a single source or if the meal is a mixture of various ingredients, contaminated or adulterated. It is a subjective type of analysis, but can provide some of the fastest possible answers to complex ingredient analysis and quality problems. It is very effective at the point of ingredient receipt as the analyst can quickly evaluate the incoming ingredients for potential presence of contaminants or

adulterants before unloading the truck to prevent poor quality ingredients from entering the feed mills. However, competency in feed microscopic analysis requires well-programmed training and constant practice. Results obtained by feed microscopy in combination with those obtained by quick qualitative chemical (spot) tests often give more information about the quality of an incoming ingredient in 5-10 minutes while several trained chemists may take several hours in the laboratory. Consequently, feed microscopy can be regarded as the key front-line defense that is an essential part of the integrated quality control programs in feed manufacturing process.

This manual is intended to serve as a reference source for the new and experienced feed microscopists. Its content is divided into four general sections describing the fundamentals of feed microscopy, feed ingredient descriptions, special analytical methods in identifying minerals, drugs, antibiotics and finally, the glossary, bibliography and index for future reference.