December 3, 1962

To the Graduate Council:

I am submitting herewith a thesis written by Pokkali Ramalingam Chetty entitled "A Program For the Production and Distribution of Certified Seeds in Madras State." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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A PROGRAM FOR THE PRODUCTION AND DISTRIBUTION OF CERTIFIED SEEDS IN MADRAS STATE

A Thesis

Presented to

The Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Pokkali Ramalingam Chetty

December 1962

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ACKNOWLEDGEMENTS

The writer wishes to record the sincere appreciation to Dr. T. J. Whatley, Department Head, and to the staff of Agricultural Economics and Rural Sociology for the valuable help and guidance provided during the research and preparation of this thesis.

This study was conducted under the supervision of Dr. Cecil E. Fuller. His outstanding resourcefulness as an adviser has helped me to a great extent in recognizing what I want to study, and he has spared no pains to steer me clear of false grounds. His patience and cheerful counsel were uniform, and enabled me to do my work with greater confidence. I am at a loss to find words to express my deep debt of gratitude to my great teacher, guide, and philosopher.

My thanks are due to Dr. Robert S. Dotson and Dr. Charles A. Cleland, who were very generous in extending their guidance and advice on various occasions during my study in the University of Tennessee.

I wish to express my sincere appreciation to Dr. R. E. Garrison, Mr. R. E. Cobble, Mr. Dan R. Mayo, and Dr. O. L. Justice for furnishing valuable information regarding seed certification, processing, testing, and other aspects of seed development in the United States.

Thanks are also due to Dr. A. S. Carter, Director of Seed Control, Indiana State, and Seed Consultant to the Government of India for his valuable suggestions and appraisal of the seed situation in India.

Special thanks are to Mrs. Grady L. Adkisson for her excellent typing in a very short time, and to Miss June Wakefield for her neat

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preparation of figures.

Any omissions in this acknowledgement do not indicate lack of gratitude.

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CHAPTER I

INTRODUCTION

The production of improved varieties of cultivated plants and seeds is undoubtedly as old as agriculture itself. Seed of high vitality and proven worth plays a significant part in any effective crop improvement program. Field crops like wheat, corn, and rice, fibers like cotton, flax, and jute, vegetables like radishes, tomatoes, and brinjal, and numerous other crops produce better results with the use of quality (even certified) seed. Numerous advantages like uniform growth, disease resistance, increased yield, improvement in the quality of the product, such as fiber length in case of cotton and oil content in case of oil seeds, are some of the outstanding examples that accrue to the farmer as a result of using high quality seed.

Seed technology comprises the determination of seed characteristics associated with each variety and testing of the seeds for trueness to variety, germination, moisture content, and presence of inert matter. The processing, drying, grading, storage, inspection, and other procedures serve to safeguard the continuity of the superior germ plasm of the seed, such safeguarding being the proper responsibility of an authorized seed certification agency.

Seed certification is the system which involves keeping of pedigree records for the various improved crop varieties. It includes inspection of fields and seeds and implemention of regulations for maintaining quality control at the various stages of production, processing, storage,

and marketing of the seed. Seedsmen and farmers have real assurance of getting genetically pure seed only when they purchase or procure certified seed for trade or sowing.

Seed certification is the responsibility of the State. State governments are responsible for enforcing seed certification regulations in the United States. In the State of Tennessee, legal authority to perform this service is given to the Tennessee Crop Improvement Association which works closely with the Tennessee State Department of Agriculture and the University of Tennessee, College of Agriculture.

A. HISTORY OF SEED CERTIFICATION IN THE UNITED STATES

The development of an effective seed certification program was an important step in American agriculture. In the history of this development, there were numerous instances where private individuals took keen interest in the selection and development of superior quality seed. But the private effort to sustain and maintain quality of the seed had many limitations. In spite of great varietal merit, new varieties had little chance of achieving widespread distribution for want of organized efforts in multiplication and marketing.[1]

Seed certification programs were initiated early in the twentieth century in the United States. Workers in Agriculture Experiment Stations developed, tested, and distributed high quality seed to the farmers in lots of a few ounces, or at the most a few pounds. Agronomists and plant

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[1]Joseph F. Cox and George E. Starr, Seed Production and Marketing. (New York: John Wiley & Sons, Inc., 1927), p. 47.

breeders had relatively little land at their disposal and, therefore, could produce only a limited amount of seed.[2] Some of the new selections were lost during the first and subsequent years due to either field contamination or mixture of good seed with inferior at the time of harvest and/or storage. The inadequacies of existing methods of seed multiplication and distribution were early recognized by the agricultural leaders in a number of different states. Members of Congress distributed seeds of new varieties during the early 1900's.[3] Because of the many difficulties early experienced in increasing and distributing seeds of new varieties, agronomists at several of the State Agricultural Experiment Stations began to help growers by inspecting their seed increase fields before harvest.

Duplicity of Naming

Frequently an enthusiastic seed grower or merchandizer would rename the new release disregarding the originally designated name. It was often possible to find new release under two or more different names. It then became necessary to seek the assistance of the agronomist in identification and recertification of the variety.

The above situation prompted Wisconsin to start field inspection work by the members of the Wisconsin Agricultural Experiment Station in 1913. Missouri, Minnesota, and Ohio subsequently developed seed

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[2]Frank G. Parsons, Carlton S. Garrison, and Keller E. Beeson, Seeds, Year Book of Agriculture, 1961 (Washington, D.C.: USDA), p. 394.

[3]Ibid.

certification programs. The formation of the International Crop Improvement Association in 1919 gave the necessary impact for further organization of Crop Improvement Associations in other states. By 1961, 45 states had crop improvement associations which covered acreages ranging from a few hundred acres to those of more than 200,000 acres of crops. More than 1,500 hybrid varieties were certified in 1959.[4]

B. HISTORY OF SEED CERTIFICATION IN INDIA

The history of the development of seed certification in India corresponds with the growth and development of agricultural research. In 1919, a Royal Commission was appointed to study the various aspects of agricultural practices used in the different states and to advise the Central Government concerning the necessary organization that should be established to devote attention to research, education, and demonstration of improved agricultural methods to the farmers. Provinces like Madras, Bombay, and Bengal organized Agricultural Departments early in the 1900's. One of the major activities of the departments was concerned with seed development work. Seed improvements by way of pure line selection hybridization and the introduction of new and superior adopted varieties received utmost attention by the agronomists. The reorganization and shifting of the Indian Council of Agricultural Research in the year 1935 to Delhi gave further requisite incentive by provisions for appropriate funds and assignment of responsibilities for the direction of seed

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[4]Ibid., p. 395.

development schemes in the different states.

Nevertheless, a specific organization charged with the seed development work akin to the State Crop Improvement Associations in the United States has never been created in India. The commodity boards, like the Coffee Board, the Tea Board, the Central Tobacco Marketing Committee, and various other crop committees, are primarily concerned with problems related to the marketing of their individual crop.

Each state has established Central and Regional Research Stations whose main functions consist of development of high quality seeds suited to the soil, climate, elevation, and seasonal conditions of the different state regions. In the one crop of rice alone there are some 3,000 varieties with different morphological and agricultural characteristics. The varieties vary in their season of growth, maturation period, suitability to different conditions, like soil and rainfall, and to other special conditions like alkalinity, salinity, and flooding.[5] About 200 varieties of rice have been proven to be outstanding with all desirable characteristics and are currently in active propogation in different Indian states. Other crops, such as millets, oilseeds, fibers, spices, condiments, and fruits, have been isolated and are under cultivation.

C. METHODS OF SEED DEVELOPMENT IN INDIA

The central and regional research stations evolve high quality seed which is then tested for its performance under farmers' field

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[5]"Field and Plantation Crops," Hand Book of Agriculture (New Delhi: Indian Council of Agricultural Research, 1961), p. 120.

conditions. This is known as "nucleus" seed. The nucleus seed is multiplied on State Seed Farms. Such seed is known as "primary" or "improved" seed. When there are no adequate State Seed Farms, the nucleus seed is multiplied on private farmers' fields under seed farm agreement to observe proper precautions both during and after the stages of seed growth and harvest. This increase also is termed as primary or improved seed. This seed is distributed through the various Agricultural Depots run by each State Department of Agriculture. The annual crop-cutting experiments reveal that about 40 per cent to 50 per cent of the cropped area under rice is sown to improved seed in Madras State.

During recent years the need for a seed certification system has been studied in the country by the Indian Council of Agricultural Research. In his survey of seed certification systems used in other countries, Garrison stated the following concerning the situation in India:[6]

> The production of rice seed for distribution to farmers has been primarily confined to Governmental managed experimental stations. The seed is controlled and distributed under the supervision of the Department of Agriculture.

During the present (third) Indian Five Year Plan period (1958-1962), establishment of a National Seeds Corporation is contemplated. This organization envisages the production, distribution, and marketing of improved seed in different states. The United States Aid for International Development Mission, the Rockefeller Foundation, and the Ford

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[6]C. S. Garrison, Seed Certification in Other Countries, Address given at 37 Annual Meeting, International Crop Improvement Association, November, 1955, Winter Haven, Florida.

Foundation will cooperate with the Government of India in the establishment of such a corporation.[7]

D. SEED SITUATION IN MADRAS STATE

Rice is the traditional staple food crop in Madras State. The area under rice cultivation in 1961 was 5,778,927 acres which forms 30.2 per cent of the total cultivated area of the state.[8] About four million acres have irrigation facilities. A large number of different varieties of rice are under cultivation, and the possibility of the same variety being known by different names in different tracts is not ruled out. About 2,000 distinct pure lines of rice from different parts of the country have been gathered at the Central Research Station, Coimbatore.[9] These varieties of rice differ widely in duration, quality, texture, flavor, and adaptability to different soil, altitude, and seasonal conditions. It is therefore evident that an abundant supply of promising seed material is available in the state out of which further development can continue to be achieved.

Research and Plant Breeding

The Central Research Station at Coimbatore and the different

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[7] India News, Vol. I, No. 13, July 23, 1962, Washington, D. C.

[8] "Paddy," A Note Book of Agricultural Facts and Figures, Government of Madras, 1961, p. 139.

[9] The Central Research Station refers to the Central Farm, Agricultural College and Research Institute, Lawly Road, Coimbatore, Madras State.

regional research stations in different zones have evolved a total of 130 improved strains of rice, millets, and other crops. A detailed statement of the improved varieties that have been evolved and maintained in the different research stations in the state is given in Appendix A. The breeder seed is evolved, tested, and multiplied on these research stations under strict breeding standards. The Paddy Specialist, Millet Specialist, Oilseed Specialist, Horticulturist, Cotton Specialist, and several other crop specialists are engaged, under the direction of the Research Council of the Agricultural College and Research Institute, Coimbatore, in the planning, evolving, testing, and approving of suitable varieties in the different major crops.

Seed Multiplication

The State Seed Farms, numbering about 100, are devoted to seed multiplication. These seed farms are run by the State Department of Agriculture under the direction and control of Deputy Directors of Agriculture and District Agricultural Officers. The production of quality crop seed produced by the farms in 1958-1959 was estimated at 17,425 tons. In addition to the above farms, there are a large number of so-called "elite" farmers as well as some Agricultural Cooperative Societies that can be entrusted with seed multiplication work under the control and guidance of the Madras State Department of Agriculture

Seed Distribution

The distribution and marketing of "primary seed" or "improved seed" are performed under the direction and supervision of the District

Agricultural Officer, the Deputy Director of Agriculture, and various crop specialists through the agricultural depots attached to the Community Development Blocks in the districts. A total quantity of 39 million pounds of seed was distributed in 1958-1959 which was planted on approximately 820,766 acres of cropped area in the state.[8]

E. PROBLEM

Oftentimes sufficient seed stocks are not available at the Agricultural Depots in Madras State.[9] Old seed and seed with doubtful germination and quality passes to the hands of farmers in peak sowing season which results in poor yield and consequent loss to the farmers. Adequate storage facilities, either at the production centers (State Seed Farms) or in the Agricultural Depots, are not available. This hinders the necessary drying and storage so essential under tropical conditions of high temperature and humidity.

Oftentimes there is surplus seed of a given variety in one depot whereas there may be no stock at all of the same variety on hand at another depot. This is due to inadequate coordination between and among districts and depots. Simple germination test is the only means by which the quality of seed is determined. Seed standards as to the purity, percentage of inert matter, and trueness as to variety can seldom be

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[8] Season and Crop Report for Agricultural Year, 1958-1959, Director of Statistics, Government of Madras, p. 22.

[9] Personal experiences of the author during his service as Agricultural Demonstrator and Extension Officer, Madras State.

verified due to the absence of seed testing laboratories. Present inadequate seed processing is accomplished by manual labor, and the scope and extent of introducing processing machinery as a complementary unit to human and cattle labor deserves serious study and application.

As an approach to this problem, four general hypotheses were stated as follows:

1. The present situation in Madras State is such that demand for improved seed is not being met adequately.

2. There is a sufficient potential for production of improved seed on the Research Stations and State Seed Farms in all the crops grown in the state.

3. It would be feasible to establish an organization having responsibility for assessing seed requirements and formulating plans for the production of improved seed on the existing seed farms and Research Stations.

4. The existing situation justifies the setting up of a seed certification and crop improvement organization which would undertake the pooling of seed material together with its processing, treating, testing, storage, and distribution to the farmers, through the existing Agricultural Depots as a means of improving the food production in Madras State.

This study is an attempt to evaluate the above hypotheses and to provide additional information about the problem under reference.

F. REVIEW OF RELATED STUDIES

A survey was conducted during 1956-1958 by the South Carolina Crop

Improvement Association to determine the extent of adoption of practices with reference to the use of certified seed in South Carolina. For many years, though farmers were advised to use better seed to obtain maximum yields, it was found that they continued to use low quality seed contributing to chronic low yields and consequent losses in their farm operations. It was found that in too many instances after a variety was released it was lost or else contaminated unless a systematic procedure was followed in maintainance and distribution. Squires and Shelley, of the Clemson College Seed Certification Department, studied the extent of use of certified seed, the percentage of weed and inert matter, and the percentage of germination in each of 2100 cases. The South Carolina Cooperative Extension Service and the South Carolina State Department of Vocational Agricultural Education assisted in the survey. Totals of 21 counties and 100 farmers in each county were selected. The teachers of vocational agriculture and County Agents were entrusted with getting questionnaires completed and with collecting seed samples from the farmer's field. One copy of the completed questionnaire was placed in the seed sample bag, one was mailed to the seed certification department at Clemson, and one was retained by the agricultural worker collecting the sample. All kinds of farmers in the respective counties were included in the study, and the seed samples for each farmer were pulled from his grain drill. Samples of oats, wheat, barley, and rye were assembled at a central point in the selected counties and then brought to Clemson. Purity analysis and germination tests were conducted. The survey presents the following information.

Only 5.4 per cent of the total seed used was found to have been certified in South Carolina. Among both certified and non-certified seed, 66.4 per cent was grown by the farmers themselves and 13.8 per cent was purchased from seedsmen, and seeds bought from neighbors accounted for the rest. Among the certified seed growers, 83.07 per cent of the seed used had been purchased from the seedsmen and only 9.24 per cent was grown on their own fields, while 7.69 per cent was obtained from neighbors. On the average, certified seed was found to have a purity of 99.15 per cent and to contain only 0.77 per cent of inert matter, whereas non-certified seed was found to have a purity of 96.61 per cent and to contain 2.11 per cent inert matter. It was further found that 17.1 per cent of the seed sown, including both certified and non-certified, was tested for purity and germination before planting in the State of South Carolina.[10]

The above information stresses the importance of a sound state certified seed program, and also suggests the need for continued efforts to teach farmers about and encourage them to use certified seed.

A second follow-up survey under the leadership of Garrison was conducted in 1959 in Anderson, Florence, and Orangeburg counties of South Carolina in an effort to determine how much progress might have been made since the earlier survey. A total number of 315 farmers was surveyed in the three counties having a combined total of 9,132 planted acres. The second survey was limited to the most important county in each district,

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[10]Dr. Robert H. Garrison, Mr. Squires, and Mr. Shelley, A Study of Small Grain Planted by South Carolina Farmers, 1958, Seed Certification Department, South Carolina, pp. 1-38.

and the survey delineated the following situation.

An average of 7.62 per cent of the farmers surveyed were planting certified seed, with the balance of 92.36 per cent using non-certified, ordinary seed whose quality was not guaranteed as to viability, to freedom from weed seeds, or being of a recommended variety. The cleaned percentage of small grains seed used was 59.20 per cent, and the uncleaned percentage was 40.80, which is alarmingly high under any farming conditions. The germination percentage recorded for registered and certified seed was 93 per cent, whereas the non-certified seed averaged only 79.40 per cent. Seed purchased from seedsmen was found to have a germinating test of 92 per cent viable, a purity of 99.14 per cent, and to contain only 0.86 per cent of inert matter. This compared favorably with either farm-grown or nieghbor-supplied seed in all three characteristics considered. The second survey further pointed out the fact that farmers were not accepting the use of certified seed and that there was a continuing need for finding an effective approach to solving the problem.[11]

G. DEFINITIONS

The terms used in this study have the usual interpretation as found in the Minimum Seed Certification Standards published by the International Crop Improvement Association.[12] Where two or more terms are

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[11] Planting Seed Survey, Research Series No. 2, A study of small grains planted by farmers in Anderson, Florence, and Orangeburg Counties, South Carolina, 1959, pp. 1-46.

[12] Minimum Seed Certification Standards, 1962 (Clemson, S.C.: International Crop Improvement Association), pp. 1-94.

closely related, they are discussed together.

Variety. "The term variety denotes an assemblage of cultivated individuals which are distinguished by any characters (morphological, physiological, cytological, chemical or others) significant for the purpose of agriculture, forestry or horticulture and which when reproduced (sexually and asexually) retain their distinguishing features."

Breeder seed. Breeder seed is seed or vegetative propagating material directly controlled by the originating, or in certain cases the sponsoring, plant breeder or institution and which provides the source for the initial and recurring increase of foundation seed.

Foundation seed. Foundation seed, including elite in Canada, shall be seed stocks that are so handled as to most nearly maintain specific genetic identity and purity and that may be designated or distributed by an Agricultural Experiment Station. Production must be carefully supervised or approved by a representative of an Agricultural Experiment Station. Foundation seed shall be the source of all other certified seed classes, either directly or through registered seed.

Registered seed. Registered seed shall be the progeny of foundation or registered seed that is so handled as to maintain satisfactory genetic identity and purity and that has been approved and certified by the certifying agency. This class of seed should be of a quality suitable for production of certified seed.

Certified seed. Certified seed shall be the progeny of foundation, registered, or certified seed that is so handled as to maintain satisfactory genetic identity and purity and that has been approved and

certified by the certification agency.

Nucleus seed. Nucleus seed is seed or vegetative propagating material directly controlled and sponsored by the Agricultural Research Station in Madras State.

Improved seed. Any seed which is the progeny of nucleus seed that is so handled as to maintain satisfactory genetic identity and purity and that has been produced either in Agricultural Research Station or State Seed Farm or by other agency under the direct supervision of the State Department of Agriculture, Madras State.

Inspecting Officer. The person who is trained in seed inspection and certification work and regularly appointed by the Federal, State, or International Crop Improvement Association to perform the duties connected with seed inspection and certification.

State Seed Farm. The farms financed and operated under the control of the State Department of Agriculture in Madras State for the multiplication of improved seed for distribution to farmers.

Crop Improvement Association. A Crop Improvement Association is a body of grower members represented by the State and Federal Departments of Agriculture charged with the functions of regulating the production and distribution of certified seed by the grower members.

Samples and sampling of seed. A representative sample of each lot of seed or propagating material as it is offered for sale shall be obtained by the certifying agency.

H. JUSTIFICATION FOR SEED CERTIFICATION AND MODEL SEED PROCESSING PLANT IN MADRAS STATE

High quality seed plays a significant role in any effective crop production program. About 10 to 15 per cent additional yield may be expected when high quality seed is used, all other conditions remaining constant. In a survey undertaken by Garrison at the Pee Dee Station, South Carolina, the certified seed yielded an average of 4.2 bushels more oats per acre and 4.1 bushels more barley per acre than did non-certified seed.[13] Various surveys conducted by Garrison show that certified seed consistently maintained a purity in excess of 99.15 per cent and contained less than 1 per cent inert matter. Certified seed also consistently recorded higher germination percentages than the non-certified.

By organizing a central state seed certification agency for the certification, processing, storage, and distribution of certified seed, it would appear possible to make available an adequate supply of high quality seed for the use of farmers who have no facilities to maintain their own seed from one season to the next. Even though the large landlords in the state reserve considerable amounts of seed for their own farm use, the quality even of that seed is doubtful. By scientific assessment of seed requirements and development of a forward-looking certification effort, the risk of using "whatever seed" that might be available at the peak season can be eventually reduced or entirely avoided.

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[13] Dr. R. H. Garrison, "Certified Seed," Crops and Soils, Vol. XII, February, 1960, p. 10.

An adequate seed certification program would make possible the issue of a limited number of the most suitable and most promising seed to the different regions and thus create an incentive to produce better standard grain for consumption and trade. Such a seed certification program would enlist the cooperation of progressive farmers and other governmental and non-governmental agencies interested in agricultural development and rural welfare.

A seed certification program also could be utilized to educate farmers about the benefits of improved seed use besides helping to safeguard a timely supply of seed material. Such an organization, established as a non-profit pseudo-governmental corporation, would enjoy tax benefits and at the same time be backed up by the good will and support of the State Department of Agriculture. Such an organization would strive to minimize the cost of seed production and, thus, the benefit of moderate cost seed could be passed on to the farmer.

A certified seed program would bring to the market adequate quantities of improved seed, and it seems doubtful that private capital and effort would come forward to take the initiative in performing this important function of quality seed production and distribution in such a large measure in the state since they have not already done so.

The fact should be recognized that the availability and use of certified seed alone may not solve Madras' food production problem. But in conjunction with wise use of irrigation, proper fertilization, and adequate plant protection schemes, improved seed should certainly bring to the farmer significant benefits in the form of increased production per acre.

Workability of the Plan.

Any new plan should meet certain basic requirements if it is to be expected to achieve significant results. In this case, the existence of well-established Research Stations having an adequate number of able Crop Specialists on their staffs should help assure continued high quality crop breeding efforts which are seen to provide an important foundation for the success of the program. A large number of State Seed Farms are ready and able to give immediate attention to the multiplication of desired seed varieties. The Agricultural Depots, numbering about 350 attached to different blocks in the districts, continue to serve as distribution outlets to farmers. The Joint Director of Agriculture, in charge of seed farms, and the Seed Development Officers in the different regions constitute the nucleus of the staff that can implement the seed certification program. Therefore, the organization would be similar in function to that of the Tennessee Seed Producers Corporation. Sufficient storage and processing plants would be provided in the different administrative regions. The above organization should be under the direct supervision of the Madras State Department of Agriculture invested with the responsibility of studying the present seed situation in the state in detail and of determining both long and short range aspects of the seed certification program.

The present study further deals with the requirements of financial, administrative, and business procedures in accordance with examples available, such as the Tennessee Crop Improvement Association and the Tennessee Seed Producers Corporation, which are the first institutions of

their kind in Tennessee and the United States. However, sufficient efforts will be made to develop and suggest workable alternatives and methods suitable for Indian conditions.

Development of a Model Seed Processing Plant

To determine the most suitable location for a model processing plant for processing seeds of rice, millets, oilseeds, cotton, and other crops in Madras State, the following categories were used for collecting and analyzing data. They also were used for formulating the suggested plan for the development of the model plant.

1. General characteristics, acreages, and average yields of areas producing rice, the millets, the oilseeds, cotton, tobacco, the pulses, spices and selected condiments in Madras,

2. Crop seasons and sowing and harvesting times for the various state areas studied above,

3. Special soil and other problems, like alkalinity, salinity, and flooding that exist in the state areas, and study of control or remedial measures,

4. Potential suitability of the various areas for possible location of processing plants and storage facilities.

As regards the processing machinery described in Chapter IV, data gathered through personal interview and study at processing plants situated at Knoxville, La Vergne, and Nashville, Tennessee, form the basis for suggestions made.

CHAPTER II

ORGANIZATION OF THE TENNESSEE CROP IMPROVEMENT ASSOCIATION

A. ORGANIZATION

This chapter consists of a review of the organization of the Tennessee Crop Improvement Association, a body charged with the responsibilities of educating the public concerning seed standards and with enforcing them in the State of Tennessee. The primary intent is to present an overall description of the organization: its membership, objectives, scope, bylaws, and management. Procedures used in enforcing of certification standards in field and storage situation and the distribution relation of the foundation seed supply to the certified seed growers are reviewed. This study gives an insight into the pattern of organization and the responsibilities designated for making available quality seed to farmers in Tennessee. As a non-profit organization cooperating with research institutions and the state government on one side and interpreting and disseminating valuable seed information to the farmers on the other, the Tennessee Crop Improvement Association occupies a significant place in the agricultural economy of the state. The points to be examined here are the nature of organization, which must be sufficiently authoritative to enforce state rules and regulations in the production and processing of certified seed, and at the same time the means used to advocate that farmers adopt improved farming practices so as to produce better seed at a minimum cost and maximum profit. The unique feature of the association lies in its advantages as a cooperating agency with the

Tennessee Agricultural Extension Service, College of Agriculture, The University of Tennessee, the State Department of Agriculture, and the Agronomy Department (University of Tennessee) in a continuous campaign for the use of improved varieties and strains of the various important farm crops. The association is financed through service fees collected from the farmer members and certain field and seed inspection fees. This reflects the enthusiasm for and acceptance of the program by the farmers of Tennessee in promoting improved seed production for the mutual benefits of all.

Below are some of the important features of the constitution and bylaws of Tennessee Crop Improvement Association.[1]

B. CONSTITUTION

The Tennessee Crop Improvement Association is incorporated under the laws of the State of Tennessee as a "Corporation not for profit," and the principal office is located at Nashville, Tennessee.

Objects

The chief object of the Association is to promote the best interests of agriculture in the State of Tennessee by increasing the efficiency of improved seed production. The purpose of crop improvement is to be accomplished by:

1. Cooperating with the Agricultural Experiment Station Agricultural Extension Service, College of Agriculture, University of Tennessee,

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[1] Seed Certification Requirements and Standards, 1955-1956, Tennessee Crop Improvement Association, Nashville, Tennessee, p. 3.

and with the State Department of Agriculture to educate farmers concerning the important developments in efficient and successful seed production.

2. Cooperating with the Agricultural Experiment Station in the testing, disseminating, and propogating of superior crop varieties and strains.

3. Regulating distribution of foundation seed of highest quality for multiplication on growers' fields.

4. Promoting excellent standards for various classes of seed grown by association members.

5. Providing field and laboratory services.

6. Enforcing rules and regulations for the certification of seeds and distribution of uniform containers, tags, and seals which safeguard the interests of both the producers, firms, and dealers of certified seed.

7. Actively participating in the dissemination of information about pure seed by means of exhibits at shows and contests, where pure seed is featured, at local, county, district, and state levels, in order to make Tennessee farmers quality seed conscious.[2]

Membership

Any resident of Tennessee who is a seed grower, contract grower, seedsman, or prospective seed grower or others interested in promoting the objects of the association may become members of the association by payment of membership fee and agreement to adopt approved seed standards

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[2]Ibid.

in the production of seed on his fields.

An application for membership is accepted or rejected by the Board of Directors of the association following an investigation as to the applicant's integrity, his interests in better seed production, his ability as a seed grower, and his facilities for the proper production, care, cleaning, and storage of seed.

All the members must pay annual membership fees and abide by the constitution and the bylaws of the association.

Officers

The management of the association is vested in a Board of Directors of nine members who are active members and seed producers. Two members are represented from each grand division of the state, and three are members at large. The responsibility for the management of the organization is delegated to the Executive Secretary who is a member of the Extension Agronomy Department of the College of Agriculture, University of Tennessee.

The State Seed Council, which represents the Tennessee Agricultural Extension Service and Agricultural Experiment Station of the University of Tennessee College of Agriculture, the Tennessee State Farm Bureau and Tennessee State Department of Agriculture, acts as an advisory committee to the Board of Directors.

The Dean of the University of Tennessee College of Agriculture, the Director of Tennessee Agricultural Extension Service, the Director of the Tennessee Experiment Stations, and the State Commissioner of Agriculture or their representatives are the ex officio members of the Board of

Directors of the Tennessee Crop Improvement Association.

A Certification Committee composed of four members representing the Tennessee Agricultural Experiment Station, the Tennessee Agricultural Extension Service, the University of Tennessee College of Agriculture, and the President of the Tennessee Crop Improvement Association are the final judges as to which crops will be certified.

Duties shall be as follows:

1. The President presides over all meetings, signs with the Secretary-Treasurer all notes, deeds, and other instruments on behalf of the association, and performs all acts and duties usually required of an executive and presiding officer.

2. The Vice President, in the absence of the President, presides and performs the duties of the President.

3. The Secretary-Treasurer keeps a complete record of all meetings of the association and of the Board of Directors. He has custody of the seal of the association and signs all checks, notes, and other obligations of the association and keeps a full and accurate account of all the financial transactions of the association.

Meetings

The association holds an annual meeting, the time and place of which meeting as well as those for any special meetings are determined by the Board of Directors, and due notice is sent to each member.

Special meetings of the Board of Directors are held at the call of the President or upon the written request of three or more members of the Board of Directors, and five days advance notice is given of such meetings.

Quorum

Ten members of this association shall constitute a quorum for the transaction of the business at any regular or special meeting.

Committees

The committees listed below are appointed by the president with the duties indicated.

Auditing and Finance Committee. This committee audits the books of the treasurer from time to time. It is responsible for plans for financing the association.

The Certification Committee. This committee passes upon the certification and registration of all samples received and interprets all rules and regulations concerning inspection. Its decision shall be final.

The Publicity and Advertising Committee. It publishes seed lists and circulars, and aids in various sales campaigns for certified and registered seed.

The Commodity Committee. This committee shall represent various crops for certification, shall offer to the Certification Committee of the Board of Directors and to the State Seed Council, at an annual or special meeting, such changes in standards and regulations as will safeguard the production and certification of the various crops.

C. SEED CERTIFICATION STANDARDS

The varieties which have been tested and recommended by the

Tennessee Agricultural Experiment Station are eligible for seed certification. The association reserves the right to disqualify a recommended variety if it is proved to be of no economic value as seed in Tennessee.

A list of the major rules and regulations appears below:

1. Classification of seed stocks. The four classes of seed officially recognized by the association in seed certification are (a) Breeder seed, (b) Foundation seed, (c) Registered seed, and (d) Certified seed.

Breeder seed is controlled and supplied directly to the producers of foundation seed. The definitions given in Chapter I apply here for terms used in discussing seed certification requirements of the association. All four classes of seed must meet minimum standards of quality and purity both in field and laboratory inspections, as determined and published for different crops, if they are to be offered for sale under the name of the association.

The Certification Committee may permit a grower to continue production of certain foundation, registered, and certified seed from lots of seed if they are satisfied that rejection is not due to genetic identity and purity of germ plasm.

2. Application for field inspection. The farmer members who grow the crops by planting foundation, registered, and certified seed which is eligible for seed multiplication are entitled to apply for seed certification. Necessary field inspection forms will be furnished by the association upon request.

If the seed is obtained from sources other than those recognized

by the association, documentary evidence such as appropriate tags, sales records, and growers contracts must be submitted to the association to establish the source of the seed.

3. Filing of applications. The latest dates on which applications may be filed for field inspections are:

May 1st: Small grains, corn hybrids, tobacco, clovers, and fescue.

August 1st: Soybeans, open pollinated corn, and sorghum.

Application received after the dates specified will be accepted only if the field inspections could be programed without dislocation of the initial arrangements, and a late registration fee is charged.

4. Membership and inspection fees.

a. Membership fee. All the grower members are required to pay $1.00 as an annual membership fee.

b. Field inspection fee. Cost of field inspection and certification is borne by members of the association, through farm, field, and acreage fees which must accompany the application for field inspection. For hybrid corn, an additional fee will be charged where the grower has large areas to be inspected and more than regular field trips are involved.

c. Seed sampling charges. Charges for certification tags and seals and the cost of printing laboratory analyses on tags must be paid by the grower at the time the official samples are taken by a representative of the association.

d. Refunds and adjustments. Farm, field, and acreage fees will

be refunded if the crop is destroyed by causes beyond the grower's control and if the application is canceled in time to keep an inspector from making a trip.

No portion of the sampling charges will be refunded when the seed fails to meet the certification standards on the basis of laboratory analysis.

5. Kinds of inspection. Inspection should be made of all cropped area even though there is no surplus seed for sale. The association trained inspector is the only one authorized to conduct official inspections.

a. Rogueing. Fields producing certified seed must be properly rogued to meet field standards before inspection is conducted. Foundation, registered, and certified seed are subject to inspection as prescribed for each crop.

b. Laboratory analysis. All seed offered for sale with a certified tag must be sampled and sealed by the association inspector. Samples are drawn from the bags containing official Tennessee Crop Improvement Association samples. Official samples are to be forwarded by the inspector to the Tennessee Crop Improvement Association-approved laboratory. The grower or his representative must be present at the time of official sampling, and sampling charges paid to the inspector.

6. Tags and seals. All seed sold as certified must have an official tag and seal affixed to each container. The special Stoffel Self-Lock seal, lithographed with the proper design and trademark supplied by the association, must be used. Seals must be properly affixed to each

container by the inspector at the time of official seed sampling. Proper sealing of containers protects both producer and buyer from tampering risks. The tag should be placed halfway between the two ear ends of the bag, either sewn in or put on with a hog ring or a special wire ring for this purpose. The reason for this placement is that when tags are placed on the ear end of the bag they are often torn off in handling and shipping.

7. Standard seed containers. All certified seed must be sold in standard containers supplied by the Tennessee Crop Improvement Association for the purpose. All advertisements and seed lists should conform to the regulations prescribed by the association. Standard bags are of different sizes, most frequently used ones being the four, three, two, one-and-a-half, and one bushel capacity bags.

8. Standard packets. All seed packets must be filled and sealed under the supervision of an association inspector. All standard seed packets must be approved by the association before they are put up for sale. A representative sample from the entire lot of the seed should be taken by the inspector. Germination and purity tests must be conducted and the seed must meet certification standards before it is packaged.

9. Rejected seed. Seed that has failed to meet the requirements as per laboratory analysis should not be marketed. Such sale of seed infringes on the Tennessee State Seed Laws. Any grower who attaches certification tags to any lot of seed that does not meet the certification regulations is fully responsible by state law for misrepresentation and damages, and the member is liable to be expelled from the association.

10. Field standards. Fields for certification must be free of inseparable noxious weed seed and reasonably free of inseparable common weed seeds. The isolation distances prescribed by the International Crop Improvement Association, and as approved and followed by Tennessee State Association, should be adhered to for all of the different crops. Detailed instructions as to the required distances are supplied by the association or the field inspector concerned. There should be a clear demarcation boundary, such as a fence, ditch, roadway, or barren strip at least five feet wide, between the fields where certified seed is grown and where crops are being grown for other commercial purposes or uses.

11. Federal and State Seed Laws. Every member growing certified seed has the primary responsibility to meet all obligations arising out of sale or shipment of seed with reference to payment of local or state taxes and other payments.

12. Substandard seed in emergencies. In case of emergencies, the certification committee shall have the authority to interpret and change any of the certification regulations necessary other than those affecting genetic purity or the reputation of certified seed, as may be necessary. A "substandard" certification tag is attached in those special circumstances.

13. Carry over of certified seed. Certified seed that is carried over from the previous year must be resampled and tested. If the seed meets certification requirements, it may be sold as certified seed. It will be necessary to retag lots of old seed with new certification tags carrying complete up-to-date information.

D. INTERAGENCY CERTIFICATION

Interagency certification involves cases where a certified variety from another state is arranged to be grown in Tennessee or vice versa. In all such cases, the minimum seed standards prescribed by the International Crop Improvement Association should be met before the seed is marketed or used for seed multiplication purposes in either state.

When certified seed from another state is received in this state, complete information such as the amount of seed received and its eligibility for certification, lot numbers and laboratory reports giving purity, germination, moisture content, and other information must be forwarded to the Tennessee Crop Improvement Association before the seed is approved for sale and association tags issued for the purpose. A similar procedure has to be fulfilled before Tennessee-grown seed can be marketed in other states.

Specific seed standards both at the field crop stage and at the processing stage may be found by referring to the "Seed Certification Requirements and Standards, 1955-1956," published by the Tennessee Crop Improvement Association.

E. PRECAUTIONS IN PRODUCTION OF CERTIFIED SEED

This section deals with necessary precautions that are to be observed by the certified seed growers and processing units. The precautions, if carefully implemented, help growers to avoid the unpleasant risk of rejection of seed for not meeting the certification standards of the association. Even though the principles advocated are not new to

farmers, their adoption, including maintenence of clean cultivation, is an exacting task which is of critical importance for certified seed production. Some of the precautions will be discussed in the paragraphs that follow below.

1. Foundation seed. Foundation seed should be obtained as per the directions of the Tennessee Crop Improvement Association. Arrangements are made to make it available to the prospective growers from the Tennessee Seed Producers Corporation at Nashville. Foundation seed stocks will be made available of only those varieties which have proven to be superior and have been approved on the basis of yield tests conducted by the State Agricultural Experiment Station.

2. Planting and isolation. Only one strain is recommended to be grown by a given grower under each crop variety. When a farmer agrees to produce certified seed in wheat, barley, and oats, he has to grow a single variety of each crop in order to avoid the possible contamination of seed in production. Another important factor to be considered is the history of previous crop grown on a grower's fields. If he is producing certified seed for the first time, he should make sure he is not growing a certified seed variety on the field where the same crop was grown in the previous year and/or season. This principle applies particularly to all small grains. Manure from livestock where whole small grain has been fed shall not be used on fields on which certified seed is to be produced.

All equipment like grain drills, harvesters, harrows and discs should be thoroughly cleaned before commencing operations in the fields. The land selected must be free from other weeds such as cheat, wild

onion, and corn cockle. All seed used for recertification must be treated with a recommended seed treating material prior to planting in order to control possible diseases.

Isolation requirements for each crop should be strictly adhered to. These distances vary from crop to crop, and instructions as to exact isolation distances are made available through the field inspectors.

3. Rogueing. In the case of growing certified small grains, fields should be thoroughly rogued to remove wild onions by digging up or use of chemicals to kill the plants. During the time the grain is forming, it should be again checked and gone over and any undesirable plants removed. Such plants should be pulled up by the roots and carried out of the fields to prevent breaking off the heads. The weed plants should never be left on the field once they are pulled since this may result in rerooting and maturation of the seed.

4. Harvesting. Timely harvest and safe storage of seed are important. Combines, threshers, wagon beds, seed bins, and sacks should all be thoroughly cleaned before operations begin. The combine might be easily cleaned by opening augers on both sides of the machine and running the machine on a steep road bank and allowing it to run for about five minutes.

5. Preparation of seed for sale. All seed must be sufficiently graded and cleaned to meet certification requirements as to the laboratory analysis. A clipper cleaner is highly satisfactory for this purpose, and fan and speed should be adjusted to result in efficient and thorough cleaning.

6. Seed sales and demands. Each grower will be responsible for the distribution of his own certified seed. However, efforts are made by the association to give wide publicity by means of appropriate association leaflets and bulletins. Prompt, efficient, and courteous handling of inquiries and shipments is absolutely essential. The majority of the seed produced is marketed through normal seed trade channels.

F. PRODUCTION OF FOUNDATION SEED IN TENNESSEE

Production and continuous supply of foundation seed occupies a significant place in any effective seed development program. Plant breeders, whether involving private or public institutions, should not jeopardize their breeding program by involving themselves in too large a scale multiplication of foundation seed to manage well. Nor is it usually possible for a foundation seed producer also to embark on a breeder seed program. Therefore, the need for a separate organization responsible for the multiplication of breeder seed based on scientific safeguards guaranteeing desirable seed characteristics and varietal qualities is all the more important. The Tennessee Seed Producers Corporation serves the purpose of multiplying breeder seed and arranging to supply an adequate amount of certified seed to growers in the state. The organization and functions of this corporate body will now be reviewed briefly.

G. TENNESSEE SEED PRODUCERS CORPORATION AT NASHVILLE

The Tennessee Seed Producers Corporation was founded in 1944 for

the main purpose of providing an adequate supply of foundation and registered seed for growers of Tennessee certified seed. This organization is responsible for assuring maintenance of high quality and genetically pure new and improved crop varieties. Such varieties, of course, are developed and recommended by the University of Tennessee Agricultural Experiment Station. The corporation achieves effective coordination and cooperation by closely associating various individuals and agencies concerned with seed production in the State of Tennessee. The United States Department of Agriculture, Tennessee Agricultural Extension Service of College of Agriculture (University of Tennessee), the Tennessee Crop Improvement Association, and selected certified seed producers in the state constitute the important clientele of this organization.

The Agricultural Experiment Station turns over to the Tennessee Seed Producers Corporation breeder seed of proven quality and performance. This enables the experiment stations to make available the fruits of research in the quickest time to the largest number of farmers. The Tennessee Seed Producers Corporation increases breeder seed following which the increase is called registered and foundation seed supplies for distribution to qualified growers as per the directions of the Tennessee Crop Improvement Association. All field operations, such as planting, rogueing, and harvesting, are handled under the strict supervision of the corporation. All machinery such as discs, harrows, and combines are thoroughly cleaned before they are allowed in the fields for operation.[3]

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[3] Ibid., p. 47.

All seed is tagged in the field and trucked to the association warehouse the same day that it is harvested. Moisture and insect infestations are checked upon arrival, and the seed is placed in drying bins for mechanical drying with warm forced air if moisture is found to be too high for safe seed storage. Where necessary, seed is fumigated after drying. All seed of a single variety is cleaned, graded, and treated at the same time. This prevents mechanical mixing between different lots.

Tennessee Seed Producers Corporation is located at Nashville, Tennessee, and the facilities are among the most modern and up-to-date in the United States for handling such foundation and certified seed.

CHAPTER III

A PLAN FOR SEED DEVELOPMENT IN MADRAS STATE, INDIA

Madras State enjoys the privilege of having one of the foremost Agricultural Research Institutes and Post Graduate Colleges in India. It is the purpose of this chapter to examine the possibility of developing a suitable state seed certification program aimed at the systematic multiplication of an adequate amount of the improved seed material that is evolved as a result of considerable outlay of public support funds and scientific research. It is generally recognized that the potential exists in the state for production of breeder seed which would serve as foundation for development of a seed certification program. The progress already made in seed production on State Seed Farms, and in seed distribution through the Agricultural Depots in the Community Development Blocks, will be discussed below. The experiences of the officers of the State Department of Agriculture in seed development work in the state is a significant source of encouragement to develop this program.

A suggested plan for a Madras State seed development program envisages the establishment of three distinct, yet interrelated, wings of the organization. The suggested scope of each wing, its formation, finances, administrative set up, and functions will be considered in detail. Figure 1 shows the suggested organizational flow chart with appropriate lines of authority. Consideration will first be given to the proposed Madras State Seed Certification Board.

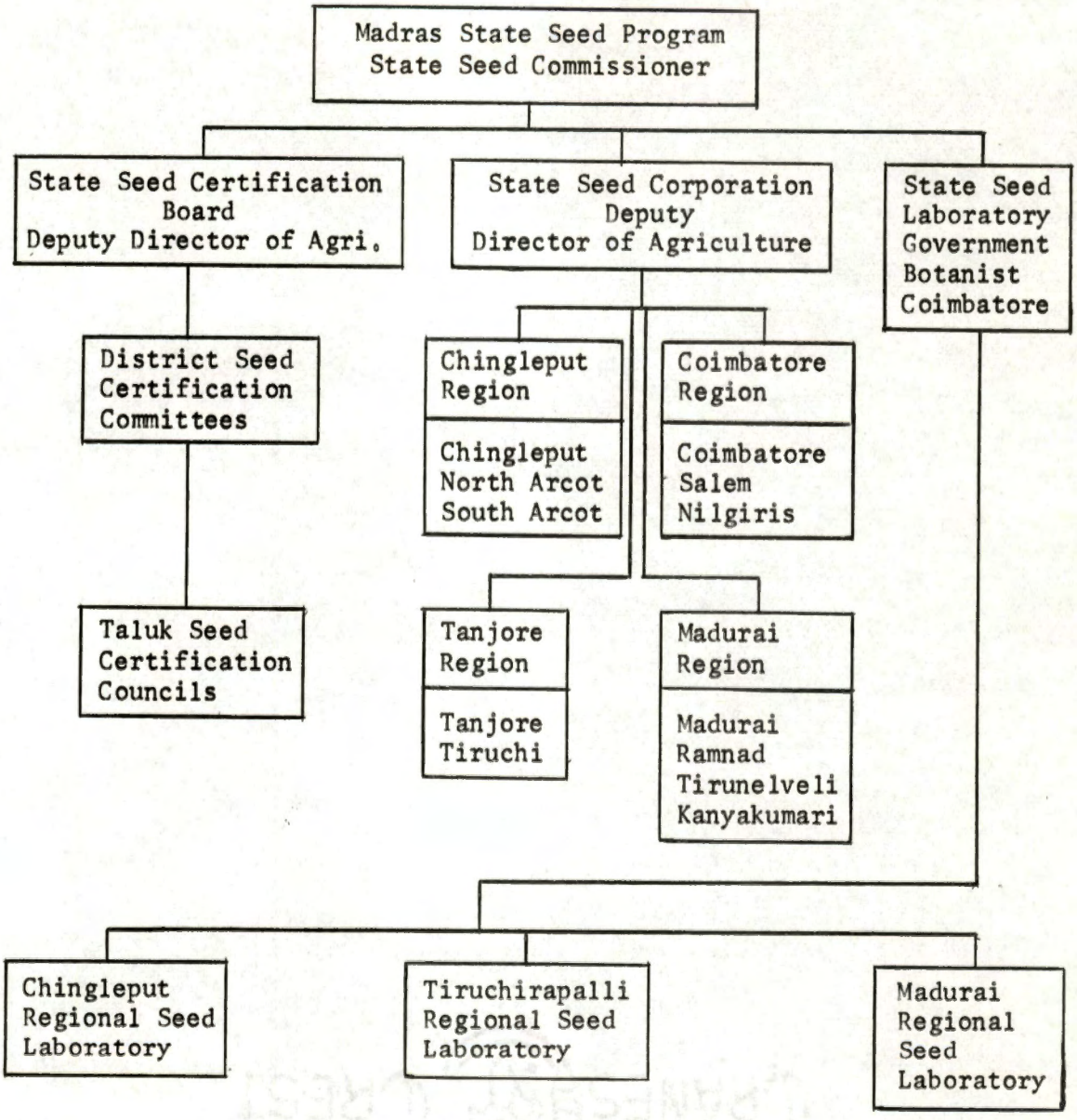


FIGURE 1

SUGGESTED ORGANIZATIONAL FLOW CHART FOR THE PROPOSED MADRAS STATE SEED DEVELOPMENT PROGRAM

A. MADRAS STATE SEED CERTIFICATION BOARD

It is proposed that this organization be authorized to function by virtue of State and Central Seed Laws such as those presently in existence in the United States. This organization would enforce seed standards, undertake seed certification, control seed movement, and educate farmers in the proper use of high quality seed suitable to the particular tract, season, and recognizing current local custom and agronomic practices being used. This would be an independent body devoted to agricultural development in general and seed certification in particular in the state. There would be no intent to replace or lessen the responsibilities of the Agricultural Extension Wing, which would continue to perform normal functions in dissemination of the latest information, including demonstration of improved seed use, to the farmers. The difference between this organization and the Agricultural Department would lie in the scope of the responsibility of this body as a cooperating agency with the Agricultural Experiment Stations, State Seed Farms, and Agricultural Depots on one side and with the farmers, other departments, and resource personnel of the peoples' representatives who are interested in rural development and welfare of the agricultural community on the other. By active representation of the officers of the State Department of Agriculture, this organization would enjoy the benefit of the guidance and close supervision of the Agricultural Department with sufficient flexibility to draw the practical farmers and resource personnel into its fold to help the board, thereby helping all the farmers of the state. A significant part of the proposal for this new organization would be its suggested

method of financing to be from its own service operations. No funds either from the state or central budget would be anticipated, even though financing by the State Government in the initial stages is not precluded.

Constitution

The State Seed Certification Board shall have legal entity by recognition by Central and State Seed Laws. This organization will best serve its intended purpose if established as a "corporation not for profit" as found in the present organizational setup in Tennessee.[1]

Bylaws

The bylaws of the board should be best determined by the members associated for that purpose. However, the following objectives may serve as a guide to such future organization.

Objects

1. The chief object of the board will be to promote the interests of agriculturists in general and assist to help the farmer obtain high quality seed at a moderate price in required quantity and in the proper season.

2. The purpose of the seed certification will be accomplished through cooperation with the State Department of Agriculture in mobilizing the resources of scientific research, seed production, and distribution.

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[1]"Seed Certification Requirements and Standards," Constitution and Bylaws of Tennessee Crop Improvement Association (Nashville: Tennessee Crop Improvement Association, 1955-56), p. 3.

3. To determine the seed standards for all appropriate crops in the state.

4. To conduct field surveys to find out the nature and use of improved seed.

5. To conduct seed inspections at production, storage, and distribution centers in the state.

6. To enforce seed movement and control when authorized by law.

7. To educate farmers in high quality seed multiplication and use.

8. To maintain necessary seed history and pedigree records.

Membership

The State Seed Certification Board will be constituted by the farmers' representatives of the District Farmers' Forum[2] and/or any other suitable farmers' organization which would represent the interests of the farmers without political and communal affiliations and be generally accepted by farmers of the state as being representative. Thirteen members, one member from each of the twelve districts and one from Madras City, representing urban garden interests, will form the nucleus of the board. Others may be seen by referring to Table I.

The State Department of Agriculture will cooperate with the board by lending the services of an officer of the rank of Deputy Director of Agriculture who will function as executive secretary of the board, and who will be mainly responsible for the orderly conduct of the business of

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[2]A nation-wide, non-political organization serving the interests of farmers in Madras State.

TABLE I

SUGGESTED MEMBERSHIP OF THE PROPOSED MADRAS STATE SEED CERTIFICATION BOARD, DISTRICT SEED CERTIFICATION COMMITTEE, AND TALUK SEED CERTIFICATION COUNCILS

Membership of the State Board		Membership of Each of the 12 District Committees		Membership of Each of 100 Taluk Councils	
District Representatives	13	Taluk Representatives	10	Block Representatives	5
Director of Agriculture	1	District Veterinery Officer	1	Livestock Inspector	1
Joint Director of Agriculture (Seed Farms)	1	Deputy Registrar of Cooperative Societies	1	Cooperative Inspector	1
Dean of Agricultural College	1	Member of Parliament	1	Farm Managers	3
Director of Animal Husbandry	1	Member of Legislative Assembly	1	Member of Legislative Assembly	1
Director of Statistics	1	Secretary	1	Seed Certification Inspector	1
Registrar of Cooperative Societies	1				
Member of Parliament	1				
Member of Legislature	1				
Secretary of the Board	1				
Total (22 in State)	22		15 (180 in State)		12 (1200 in State)

the board. Other senior officers of the department, namely the Joint Director of Agriculture for State Seed Farms, the Dean of the Agriculture College and Research Institute, Coimbatore, Regional Deputy Directors, and the State Marketing Officer will be ex officio members of the board.

Cooperating Agencies

Representatives of other departments and agencies, resource personnel, and people's representatives will be coopted as cooperating members of the board. The Director of Animal Husbandry or his representative, Registrar of Cooperative Societies or his representative, President of the State Farmers' Forum, and one member of Parliament and one member of the State Legislature will represent the interests of the public on the board.

Officers and Duties

The management of the board shall be vested with the members of the board and the executive secretary,who is a member of the State Agricultural Service, will be delegated full responsibility in association with the elected president in performing all routine duties to achieve the stated objects of the board.

The specific duties, responsibilities, privileges, conduct of meetings, terms of office, methods of election of office bearers other than the executive secretary, and all other organizational and administrative details will have to be determined and adopted in the same way as found with the different commodity boards, like the Coffee Board, the Tea Board, and the Rubber Board, which were constituted for the development of respective commodities.

Committees

There will be several committees to carry out the specific objects and aims of the board. Qualification for membership on a particular committee will envisage special knowledge, aptitude, and skill of the member to perform the duties on the committee. Excepting the Seed Certification and Research Committees, all committees give opportunity for a fair representation of the members. Some of the suggested committees will be listed and their functions discussed separately.

1. Seed Certification Committee
2. Research Committee
3. Finance and Audit Committee
4. Public Relations Committee
5. Commodity Committees
   a. Grain Committee
   b. Oilseeds Committee
   c. Cotton Committee
   d. Pulses and Condiments Committee

Certification Committee. This committee will be responsible for passing on certification or registration of all samples received, and will interpret all rules and regulations concerning inspection. It will maintain seed history and pedigree records.

Research Committee. The Research Committee will study all problems involved in seed certification and indicate lines of research to be conducted on specific problems and crops. New seed varieties will be

studied, and suitable methods suggested. It will conduct periodic surveys of the use of the certified seed in the state and advise the Finance Committee concerning monetary needs when any research project is undertaken.

Finance and Audit Committee. This committee will be responsible for securing finances by timely assessment of certification fees. It will audit receipts and expenses of the board. This committee also will delegate powers to the president and secretary to incur all recurring and non-recurring expenditures of the board.

Public Relations Committee. The Public Relations Committee will explore all means and ways to focus attention of farmers on the advantages of improved seed use. To achieve this objective, the following methods are suggested:

1. Use of seed information bulletins
2. Seed movies and slides
3. Radio talks
4. Seed seminars

It will study the Central and State Seed Laws and present interpretations and working regulations regarding seed movements to the secretary. It will offer advice on necessary further seed legislation in the state.

Commodity Committees. The Commodity Committees will study the problems related to each commodity and advise the seed Certification and Research Committees accordingly. This committee recommends seed movement

controls, the importing of promising new seed varieties, and other matters related to that particular crop or crops which the committee represents.

Finance

As indicated earlier, a seed certification program should grow and take roots in the state on its own merits as a service organization. Its duties will be vast enough to be never ending since seed problems are bound to remain as long as cultivation exists. It is presumed a farmer will be happy to pay a fee of 10 naya paisa or 20 Np. (2 to 4 cents in United States currency) per acre to obtain sound, guaranteed seed in preference to gambling by purchasing whatever seed may otherwise be available to him. It is, therefore, suggested that the fee on certified seed sales not exceed Rs. 0.20 per acre planted. The fee should be collected at the sales point by the personnel of the Agricultural Depots and credited to the board.

It is proposed that the program could start with 7,981,000 acres (about 45 per cent) of the 17,092,558 total cultivated acres in the state. By means of the certification fee suggested earlier, a revenue of Rs. 1,298,000 per annum could thus be expected. Details concerning the total area under crops and the suggested areas intended to be planted with certified seed will be found in Appendix B.

Estimated Annual Expenditures. The board will have a State Office, 12 District Offices, and 100 Taluk Offices and the estimated annual expenditure for each category is shown in Table III. Details of current

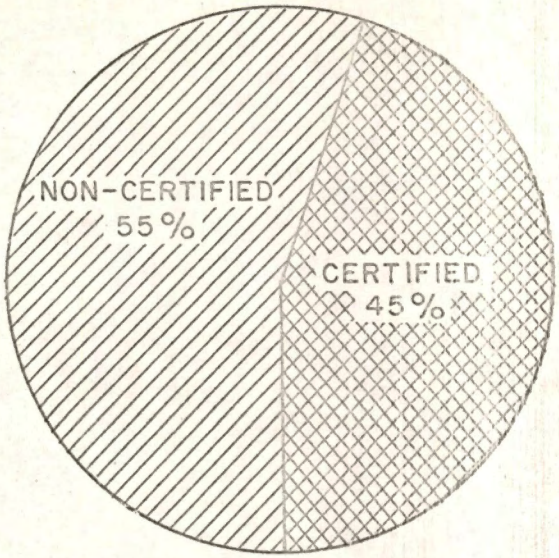
TABLE II

ESTIMATED ANNUAL REVENUE FROM FEES TO BE COLLECTED FOR SALES ON CERTIFIED SEED ON TOTAL PROPOSED CROP ACREAGES IN MADRAS STATE IN RUPEES AND PER CENTS*

Crops	Total cultivated acreage in Madras State	Proposed acreage to be planted with certified seed	Percentage of estimated annual revenue	Estimated annual revenue (Rs.)
Food crops	11,502,632	5,806,000	72.8	981,200
Pulses	899,469	375,000	4.8	37,500
Oilseeds	2,753,674	1,200,000	15.0	220,000
Fibers	952,317	500,000	6.2	50,000
Condiments	556,594	100,000	1.2	10,000
Sugars	96,780	..	..	..
Other crops	331,092	..	..	..
Total	17,092,558	7,981,000	100	1,298,700

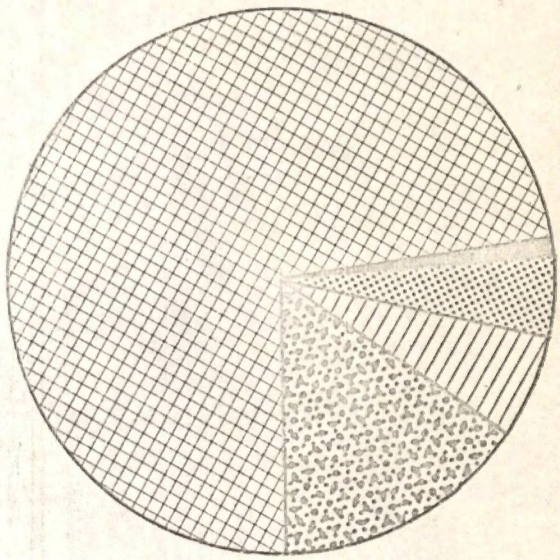
*Adapted from A Note Book of Agricultural Facts and Figures, 1961, (Madras: Superintendent of Government Press, 1961), pp. 139-226.

TOTAL AREA



Non-certified	55.0 %
Certified	45.0 %
Total	100.0 %

CERTIFIED SEED AREA



	Food crops	72.8 %
	Pulses	4.8 %
	Oilseeds	15.0 %
	Fibers	6.2 %
	Condiments	1.2 %
	Sugars	. . .
	Other crops	. . .
	Total	100.0 %

Figure 2. Total Cropped Area and Certified Seed Area in Madras State (Estimated).

Source: Agricultural Facts and Figures, 1961. Government of Madras.

TABLE III

ESTIMATED ANNUAL EXPENDITURES OF VARIOUS OFFICES OF THE PROPOSED MADRAS STATE SEED CERTIFICATION BOARD IN RUPEES AND PERCENTAGES OF THE TOTAL

Specified Board Offices	Estimated Total Annual Expenditure (Rs)	Per cent of Total Annual Expenditure
The State Office	33,200	3.1
Twelve District Offices	196,500	18.5
One Hundred Taluk Offices	834,000	78.4
Total	1,063,700	100.0

pay scales, allowances, and other miscellaneous items of estimated expenditure may be found by referring to Appendix C.

As seen in Table IV, it is estimated that the board would annually accrue a surplus of about Rs 246,700 which would be designated partly for research and partly for reserve fund.

Field Service

The success of the Seed Certification Board will depend upon the efficiency and thoroughness with which it can conduct its field services. Efforts should be made to spread such services evenly at District and Taluk levels. Thus work will be aimed at the grass roots focal point and will be based on contact with farmers.

District Committees

A Seed Development Officer of the Madras State Department of Agriculture will function as the secretary of each District Seed Certification Committee. This committee should be composed of representatives of Taluk farm organizations, and will normally consist of 10 members one of whom will be elected as chairman. (See Figure 1, page 38, and Table I, page 42, under District Committee.)

Representatives of cooperating government agencies involved at the district level are the officers of the Animal Husbandry, Cooperation, and Rural Welfare Departments. On the non-governmental side, various resource personnel, people's representatives, members of Parliament and members of the State Legislature will serve to represent the other interests on each District Committee.

TABLE IV

ESTIMATED ANNUAL RECEIPTS AND EXPENDITURE OF THE PROPOSED MADRAS STATE SEED CERTIFICATION BOARD

Source of Revenue	Revenue (Rs.)	Purpose for expending funds	Expenditure (Rs.)
Seed certification fees	1,298,700	State Office	33,200
		District Offices	196,500
		Taluk Offices	834,000
		Research and Reserve fund	235,000
Total	1,298,700	Total	1,298,700

The actual duties to be performed by each of the District Committees and the scope of its activities will be left for determination by the State Seed Certification Board. However, a number of general suggestions may be useful at the start. They will be listed below.

1. State Seed Farm operation and advising
2. Seed requirements for the district
3. Seed transfers and movement
4. Seed information and publicity

Taluk Seed Councils

There will be a divisional or Taluk seed council in every revenue division or Taluk. The division or Taluk Seed Certification Council will have the services of a Seed Certification Inspector (an Agricultural College graduate) who also should supervise one of the State Seed Farms in the Taluk. The Seed Certification Inspector would be placed in the important role of protecting the interests of farmers by supervising the production of high quality seed on the State Seed Farms while keeping in touch with seed requirements and seed trends in the entire division or Taluk. Among other duties, also should be the responsibility of the inspector to arrange for a supply of suitable seed in required quantity to be on hand at each of the Block Development Agricultural Depots in his jurisdiction.

In brief summary, then, the duties of the Taluk Seed Council and its Seed Certification Inspector will consist of:

1. Inspection of seed in agricultural depots regarding germination, purity, inert matter of seed, and trueness to variety.

2. Watching the seed stocks and advising transfer of seed stocks from one depot to another or to the district godowns as needed.

3. Inspecting all seed movements under his jurisdiction.

4. Conducting educational and publicity efforts concerning the use of certified seed.

5. Helping investigators in conducting field surveys.

B. MADRAS STATE SEED CORPORATION

The State Seed Corporation would form an important link between production sources, like the various State Seed Farms, and the sales outlets (the agricultural depots in the state). Within the proposal for establishing a state seed organization, it is recognized that there will be many difficulties involved in the processing of seed on the State Seed Farms. It is further recognized there are certain limitations to be met with such as inadequate storage space at most of the agricultural depots. Vagaries of nature create sudden demand in peak seasons, and proper distribution in required quantities for a given season becomes difficult task both for the depots and for the State Seed Farms as well. History shows that shortages in one area and surpluses of seed in another are not uncommon.[3] It is therefore felt that there is scope and need for a separate organization to undertake the functions of collecting seed produced on the state farms, processing seed (including drying, cleaning,

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[3]Dr. A. S. Carter, "Progress in the Seed Improvement Program in India, 1961," American Embassy, New Delhi: United States Agency for International Development, p. 1, (mimeographed).

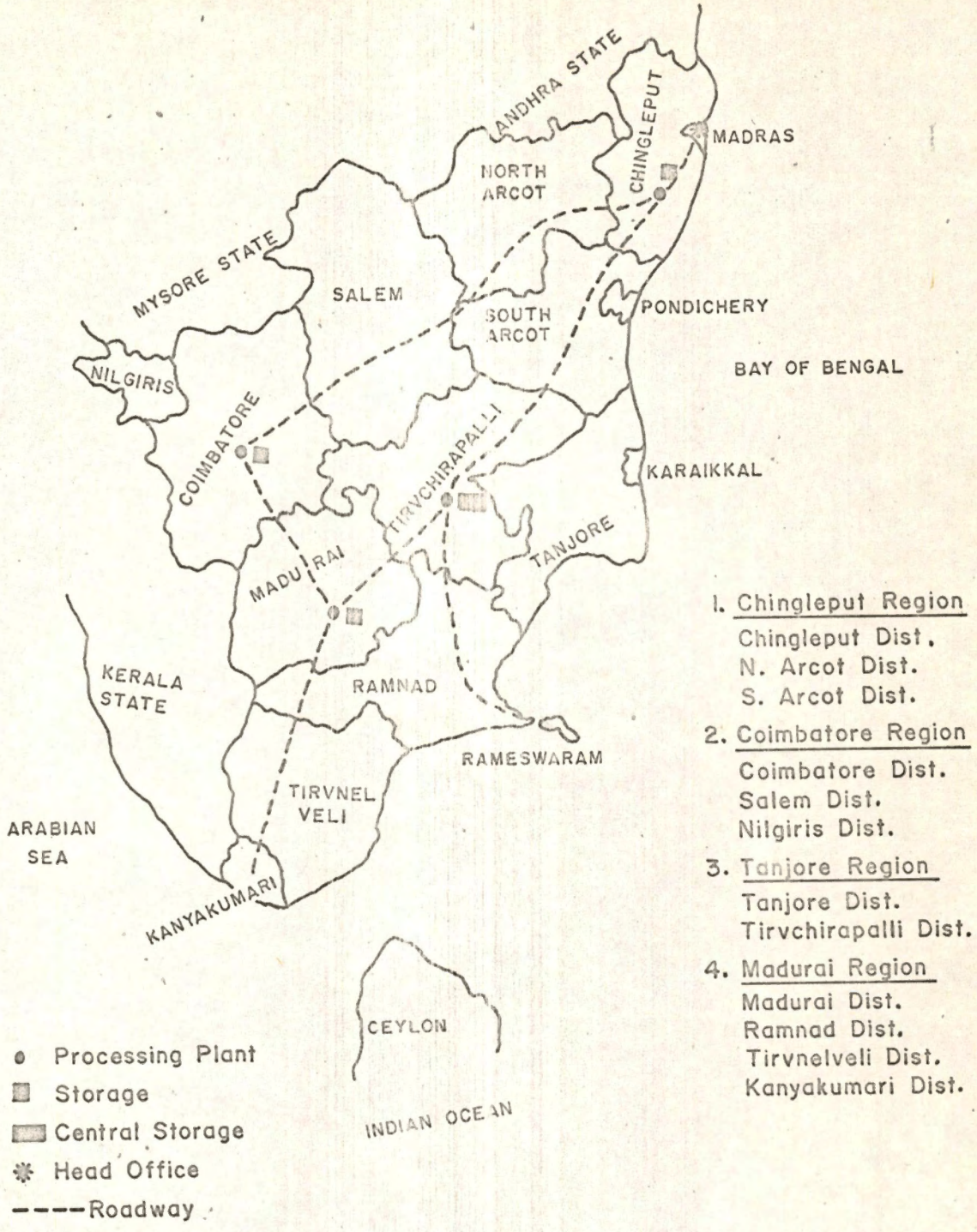


Figure 3. Proposed Regions of the Madras State Seed Corporation.

and treating with chemicals), and supplying the seed to the agricultural depots for distribution to the farmers. The profit motive does not arise here even though some working margin and reserve fund must exist to help safeguard the best interests of the organization.

The following three possible types of state seed organizations will now be considered, and the advantages and disadvantages of each will be analyzed:

1. A State Government Organization financed and run by the State Department of Agriculture.

2. A Cooperative Corporation could be set up under the supervision of the Agricultural Department and with the cooperation of seed producers and farmers.

3. The aid of private enterprise could be entrusted either as a private company or individual concern.

Alternative 1: The State Seed Organization as a Government Organization

Under this approach, it would become a part of the State Agricultural Department. The present practice of allotting seed from various State Seed Farms to adjoining agricultural depots might have to be continued. There would be no participation of farmers in helping decide on the suitability of varieties to a particular region. As stated earlier, the present system has caused shortages in some regions and surpluses in others. Therefore, the seed problem deserves a long-range planning approach and solution. The administrative bottlenecks inherent in this system do not permit the required flexibility needed by a trading corporation. It would seem highly doubtful whether or not these functions

would be best served by the present system of seed distribution.

Alternative 2: The State Seed Organization as a Cooperative Corporate Body

A public corporate body organized along the lines of the Tennessee Seed Producers Corporation, Nashville, Tennessee, would enlist and assure the active support of the State Agricultural Department, the State Experiment Stations, the State Seed Farms, the people's representatives, and the farmers themselves. It would pave the way to achieve practical benefits for the farmer. The possibility of private farmers and agricultural cooperatives engaged in seed production supplying seed to this organization would not be ruled out once the latter met the seed standards prescribed by the seed certification board. Selection of this alternative would presuppose active participation of farmers on its Board of Directors by capital share and membership. The Reserve Bank of India, which actively promotes the interests of farmers by lending considerable sums to agricultural credit societies, should have no objection to providing finances needed for purchase of machinery and construction of storage facilities which can be paid back in suitable amortized installments.

Alternative 3: The State Seed Organization as Private Enterprise

Private individuals or firms have not made any organized efforts to undertake seed processing beyond selling various horticultural seeds and plant materials in the state. Certain opportunistic traders have been known to sell inferior grain varieties as "seed" to desperate farmers trying to catch up on their sowing during peak monsoon seasons. In light

of this history, it would seem doubtful that much private capital and efforts will find their way into seed processing in the state in the near future.

The Selected Approach

Therefore, a public corporation (alternative 2 above) with ample scope for farmer participation would appear to be best suited to the need in Madras State under the present conditions. Suggested membership, organizational setup, and functions will be outlined below.

Membership. Any resident of Madras State, farmer, tradesman or cooperative society, educational institute engaged in agricultural production, or dealer in seeds could become a subscriber member of the State Seed Corporation.

The State Agricultural Department would be the sponsoring agency of the organization, and all technical personnel and resource persons and people's representatives will be coopted as ex officio members who have no voting rights in the meetings.

The details regarding the capital share, Board of Directors, duties of the president, and all other activities concerned with the operating of the organization may be determined after further study of local conditions and requirements.

The guiding principles underlined here would be farmers' benefits and their participation at all levels. The details of capital formation, administrative and business procedure need not be dealt with here since a suitable system may be adopted from organizations engaged in similar

functions in the state or outside the state. However, the broad outlines of such an approach for seed processing and storage will be delineated here.

Organization. Madras State is divided into four regions because of the operational convenience and greater travel efficiency. (See Figure 1, page 38, under State Seed Corporation.)

Each of the four regions would have a processing unit and storage facilities.

Consideration of each region would be in order to clarify the proposal.

1. Chingleput region: This region is made up of Chingleput, North Arcot, and South Arcot districts. Chingleput town could serve as a logical regional center for location of the processing plant and storage facilities.

2. Coimbatore region: This region consists of Coimbatore, Salem, and Nilgiris districts. Coimbatore city would be the regional center for location of the processing plant and seed storage facilities.

3. Tanjore region: Tanjore region includes Tanjore and Tiruchirapalli districts. The central storage and processing plants would be located at Tiruchirapalli city, which is centrally situated in the state and enjoys adequate highway, rail, and air facilities.

4. Madurai region: Madurai includes the southern districts of the state, namely, Madurai, Ramnad, Tirunelveli, and Kanyakumari districts. Madurai city would serve as a regional center where processing and storage might be located.

Processing Plants and Storage. Each processing plant in the above region receives the seed produced on the State Seed Farms. The suggested designs and capacities of the plants will be studied in the next chapter. The storage requirements will be determined after studying the quantities of seed expected from the State Seed Farms, and the quantities of seed to be distributed to the agricultural depots, seeds in transit, and, also, seed reserves to be maintained to satisfy sudden demands due to monsoon rains. A discussion of the kinds of seed and their respective quantities for each region will be found in the next chapter.

Transportation. The locations of the processing plants and storage facilities were suggested above after consideration of available highway, rail, and other transportation facilities for all the regional centers. The location of the central seed storage facility would be suggested at Tiruchirapalli since that city is centrally situated and has air connections with Madurai, Madras, and Coimbatore.

Head Office. The Head Office of the State Seed Corporation shall be located at the state capital, Madras City.

Functions. A list of functions to be performed may provide a better understanding of the suggested responsibilities of the State Seed Corporation. Its suggested functions would include:

1. Procurement of seeds of all crops grown from the State Seed Farms situated in each region.

2. Processing of seed in each region.

3. Periodic inspection of seed to satisfy certification standards.

4. Bagging and storage as per the specifications prescribed by the State Seed Certification Board.

5. Seed treatment and fumigation in handling and storage as per the seed storage requirements.

6. Supplying of seed to different districts and depots as per the needs made known by seed development officers in the various districts.

The State Seed Corporation would not conduct retail sales. All sales would be channeled through the agricultural depots in the Community Development Blocks. The seed processed and supplied to the depots should strictly conform to the certification specifications prescribed by the Seed Certification Board. Substandard seed received from State Seed Farms should be rejected.

The administration, pricing policies, margins, bagging, trademark, labels, seals, and detailed distribution would be handled with utmost economy in agreement with the rules and regulations agreed upon for the corporation.

C. MADRAS STATE SEED LABORATORY

Until the present time, seed testing has received a very limited amount of attention in Madras State. The germination test is the only test available to the agricultural demonstrator at his depot. The large scale practice of pooling seed from different State Seed Farms with different degrees of moisture content and purity necessitates constant watch to try to safeguard the seed quality. In a tropical country like Southern India, high temperature and relative humidity are common. Any

mishap which results in poor drying will probably result in wholesale deterioration of the quality of the seed. Accurate seed analysis and information should be available to guide the farm manager, processor, and warehouseman during different stages of seed handling and storage, and, finally, the farmer should be in a position to know the quality of the seed he is sowing.

Seed testing is further complicated by inherent biological complexities of seed and by the many legal intricacies encountered in trying to enforce seed rules and regulations in the state.

Situations are common where quick testing of seed would facilitate seed transportation from region to region.[4] The farmers in the state naturally continue to be greatly concerned about the cost of seed. They are relatively insensitive to qualities of purity, germination percentage, and presence of noxious and other weeds. They look primarily for cheapness in price. Therefore, the objectives of seed testing and certification should be given wide publicity for the benefit of the farmers, namely:

1. To sell the idea that farmers should only buy and plant high quality seed.

2. To encourage all citizens to observe the state and central government seed laws.

3. To motivate farmers to have all home grown seed tested before

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[4]R. P. More, "Quick-Test Seed Tests," Fifty Years of Seed Testing, Association of the Official Seed Analysts of the United States, 1958, p. 75.

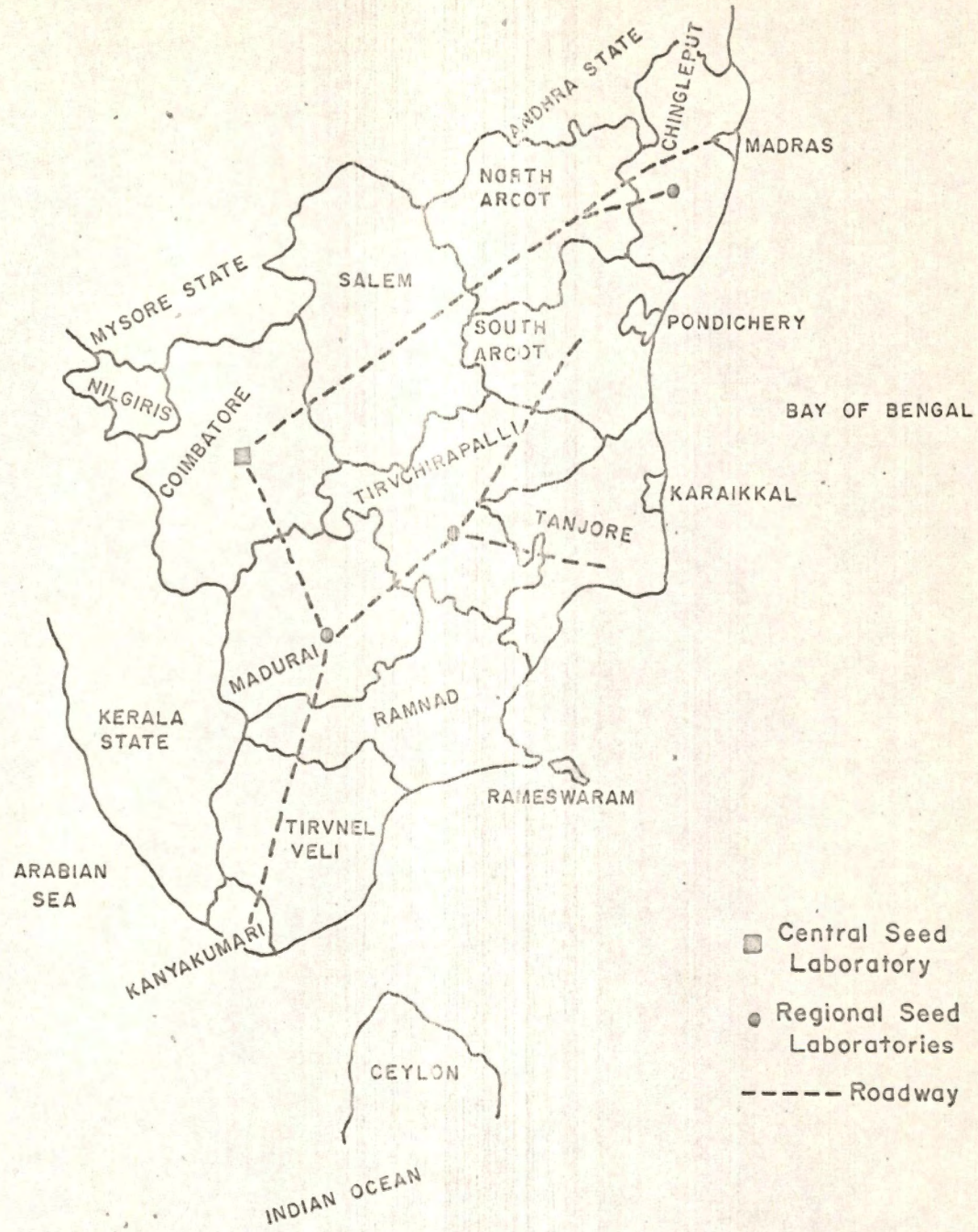


Figure 4. Location of Proposed Central and Regional Seed Testing Laboratories, Madras State.

it is planted.[5]

To meet the requirements of seed analysis, a network of seed testing laboratories to conduct seed analysis and testing are proposed. (See Figure 4, page 62, under State Seed Laboratory.)

The Central Seed Laboratory functions under the control and supervision of the Dean of College of Agriculture, Coimbatore. The Seed Verification Officer will work under the dean and control the proposed regional laboratories at Chingleput, Tiruchirapalli, and Madurai. This organization would be purely a part of the State Department of Agriculture program to implement improved seed standards.

The tools, buildings, and other operational requirements for setting up State Seed Laboratories would be the responsibility of the State Department of Agriculture, Madras. A detailed discussion of pertinence in this regard may be found in the publications issued by the Association of Official Seed Analysts in the United States.

However, it is to be noted, in the initial stage just the Central Seed Laboratory at Coimbatore may be sufficient as a start. Regional laboratories may be organized at a later stage, if necessary. Though the scope of this study does not permit elaborate description of seed testing laboratories, their chief functions would include the following:

1. Seed analysis to determine
   a. Trueness as to variety
   b. Germination

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[5]L. E. Everson, "The Need for Extension," Fifty Years of Seed Testing, op. cit., p. 87.

c. Moisture

d. Percentage of inert matter and weeds present

2. Interpretation and application of seed standards to seed samples received from the State Seed Corporation, Seed Certification Inspectors, and farmers throughout the state.

3. Conduct of research in seed longevity, storage, and vernalization.

4. Education of the farmers to be more seed quality conscious.

CHAPTER IV

DEVELOPMENT OF PROCESSING PLANTS IN MADRAS STATE

A. SEED PROCESSING IN GENERAL

Adequate processing and storage occupy important places in any seed development program. It is here recommended that the proposed Madras State Seed Corporation locate regional processing plants and warehouses at Chingleput, Coimbatore, Madurai, and Tiruchirapalli which are intended to receive seed produced by the State Seed Farms, Agricultural Cooperative Societies, or private farmers who enter into agreement with the State Seed Corporation to produce and supply seed conforming to the set certification standards.

It is presumed that some 7,981,000 acres could be planted to certified seed in the state at the outset or shortly thereafter. The acreage is suitably allocated between the various regions, taking into consideration the variability of the crops, the seasons, the soils, the topography, and the agronomic practices followed. The seed processing machinery would be a new introduction to the state. The question may arise as to whether or not introduction of the machinery might cause displacement of agricultural labor. But processing equipment is seen to be indispensible to the streamlining of seed production and distribution. There need be no such fears of displacement of labor if the histories of the economic development of various other one-time relatively less-

developed states and nations would apply here.[1] The effects of the presence of several rice hulling and sheller machines in each community at the present is an example of the recent introduction of agriculturally-related machinery that has made more jobs rather than fewer. On the contrary, an increased number of laborers may be found to be necessary in the future for loading, unloading, stacking, and transporting necessary with stepping up seed production and processing. Uniformity and quality of product, speed, and large volume turnover and economy of operation demand the use of modern processing machinery suitable to Indian conditions. For this purpose, machinery models incorporating desirable mechanical advantages have been considered. It was with this in mind that seed processing plants of different models and capacities, namely, those of the Strong Stock Farm and Mayo Seed Company (Knoxville, Tennessee), the Tennessee Seed Producers Corporation (Nashville, Tennessee), and the Tennessee Farmers Cooperative Association (La Vergne, Tennessee) were studied. Discussions with the managers of these processing plants have provided information concerning the different machinery available: their models, capacities, and relative advantages. It is believed that the machinery suggested below will meet the requirements of the proposed Madras State Seed Corporation for implementation of an adequate seed program.

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[1]W. W. Rostow, "Agriculture and Extractive Industries," The Stages of Economic Growth, Cambridge University Press, 1961, pp. 21-24.

Seed Processing

It is the considered view of seed technologists and agronomists that processed seed is superior to ordinary seed. According to Klen and others, "seed as it comes from the field is never pure."[2] Concerning the item of clean seed, Hart made the statement that:[3]

> The importance of good seed cannot be over estimated. I am of the opinion that if every community throughout the Province had a power seed cleaning machine at its disposal, such a machine could pay for itself many times over each year in the increased yield per acre alone.

The processing of seed is seen to be comprised of the following steps: drying of the seed, cleaning of the seed, and seed treatment, such as hulling, scarification, and delinting in the case of cotton seed. Seed treatment with fungicides and pesticides helps protect the seed from pests and diseases during storage and in the field at planting time. Packaging, transporting, handling, and storage form the final stages in certified seed production. The paragraphs that follow below will include discussion of the seed processing steps.

Drying of Seed. High moisture in seeds during storage is one of the chief reasons for loss of viability of the seed. The moisture affects the respiration rate of the seeds. At moisture levels above 20 per cent, micro-organisms may produce heat rapidly enough to kill the

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[2]Leonard M. Klen, James Henderson, Abraham D. Stoesz, "Equipment for Cleaning of Seeds," Seeds Year Book of Agriculture, 1961 (Washington, D.C.: USDA, 1961), p. 307.

[3]F. C. Hart, "Seed Cleaning Plants in Ontario," The Agricultural Gazette of Canada, 1921, Vol. VIII, p. 150.

seed or even start fires in the seed mass. Also, seed may suffer mechanical damage in handling and processing more easily if its moisture content is too high. Molds tend to grow in moist lots of seed. Insect damage also is encouraged by too high seed moisture. Furthermore, damp seed tends to stick together and interfere with the proper feeding and operation of seed processing equipment.

Seeds, if moisture levels are too high, must be dried to a proper level if processing and storage are to be done satisfactorily. In olden days, drying was accomplished naturally in the heat of the sun. Artificial drying is a relatively recent innovation. Drying, simply stated, may be said to mean the evaporation of moisture from the seed. Drying of seed can take place only when vapor pressure of the moisture is greater than the resisting vapor pressure of the surrounding air. The rate of drying drops as the differential of the vapor pressure decreases. Consequently, considerable time may be required to remove the desired last one per cent of moisture. The final moisture content for safe storage of most seed is in the range of from 4 to 14 per cent, depending on the kind of seed, the type of storage used, and the anticipated storage period.[4] Moisture of seed may be said to be of two kinds. One is surface moisture and the other is internal moisture. Obviously, surface moisture of the seed occurs on the outer surface of the seed. Internal moisture is distributed throughout the inner parts of the seed. Its removal, technically

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[4]N. Robert Bradenburg, Joseph W. Simons, and Lloyd L. Smith, "Why and How Seeds are Dried," Seeds, Year Book of Agriculture, 1961 (Washington, D.C.: USDA, 1961), p. 298.

speaking, involves capillary action or diffusion of the moisture to the surface, where evaporation can take place. The above physiological conditions are considered and utilized in the construction and operation of various drying appliances available on the market today. Artificial drying permits earlier harvest and reduces chances of loss from bad weather. It provides for handling of unusually large yields of seed with relatively fewer losses from over-ripening and shattering. Early harvest also tends to lower damage from insects and birds. Artificial drying has been proven to be dependable and to afford savings of labor and time.

The equipment commonly used for drying in the United States consists of drying bins, portable driers, tunnels, and column driers. Because of its advantages for use in Madras, this study will only consider the use of column driers of various approximate sizes and capacities.

Working of Column Drier

This is a stationery type drier which works continuously. The capacity of the drier is 200 to 300 bushels per hour, and it requires a 10 horsepower motor for operational power. The seed is fed in at the top of the column and it proceeds to move down through the column by gravity flow. The seeds are dried during their movement from the top of the drier to the bottom and are discharged at the bottom of the column. They are thereupon elevated into storage or on into the processing plant. In case of the high-moisture seed, more than one pass through the drier may be required to reduce the moisture content to the desired level. Driers are available in various sizes. Thorough drying of 75 to 100 bushels of

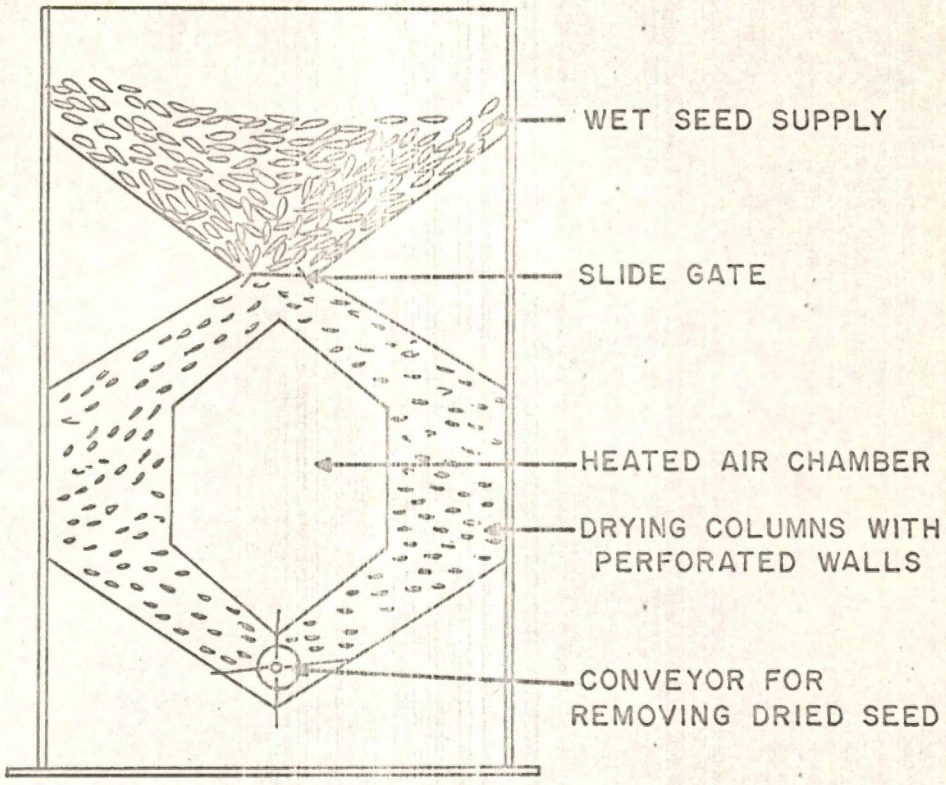


Figure 5. Sectional View of Column Drier.

heavy seed usually requires about one gallon of fuel oil per hour for drying. The size of the drier required in a plant is determined according to the average daily load to be placed on each drier.

Cleaning of Seed. Seed contains many impurities of different kinds and degrees when it is received from the field. Seed from each crop is basically different in its physical makeup than that of seed of each other crop in size, shape, weight, surface area, specific gravity, color, electrical properties, texture, stickiness, and pubesence. These characteristics can be measured or sensed by mechanical devices called separators which cull unwanted weed and other seed from the pure seed desired, based on such purely physical differences. Seed separators also remove dirt, leaves, stems, and chaff. All seed crops, whether of grasses, legumes, grains, vegetables, flowers, trees, or shrubs, require some cleaning. Consideration will now be given to selected cleaning devices.

Air and Screen Separator

The air and screen type of machine makes use of aspiration, scalping, and grading screens in the cleaning process. Seed is fed into the cleaner from a seed hopper. As it falls from the hopper, the seed passes through upper air suction which removes most of the lighter chaff and dust before the seed reaches the top of the first screen. This screen is used for rough scalping. The perforations in this screen should be long enough to let the seed being cleaned drop through readily, and to force larger foreign material, such as stems, sticks, and dirt, to remain on the screen and be separated there. The seed which passes through the

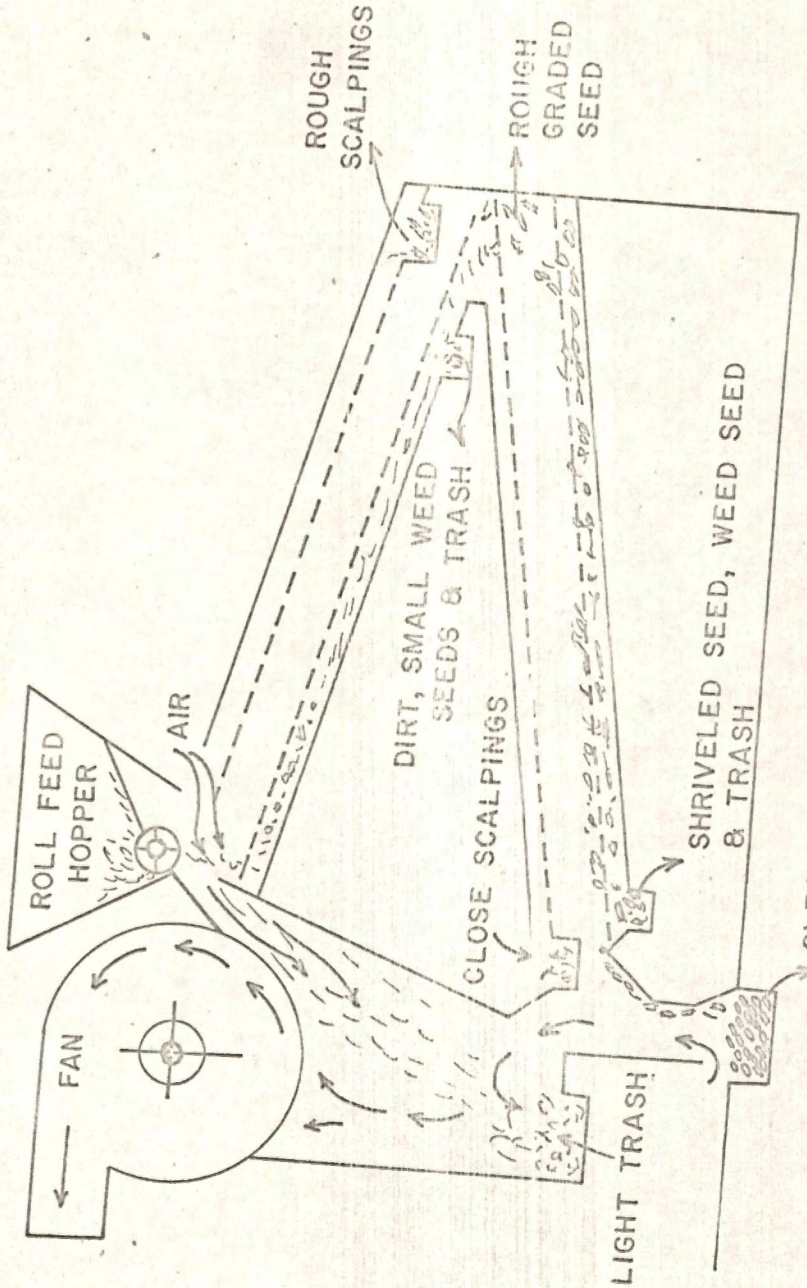


Figure 6. Schematic View of Air Screen Seed Separator.

first screen is caught on the second screen. The perforations in this screen are just large enough to allow small trash, small weeds, and dirt to drop through, separating these out at this stage. The now relatively pure seed rides over the second screen and drops off onto the third screen which serves as a close scalper. It removes any foreign material or larger seed which escaped the first screen. The seed that drops through the third screen goes over to the fourth screen for the final close grading where split and immature seed is finally removed.

Gravity Table

The specific gravity separator removes lighter seed from heavy seed and works on the flotation principle. A mixture of seed is fed onto the lower end of a sloping perforated table. When the air is blown over it, the lighter material reaches the top and the seed is stratified into layers according to the density of the seed. The gravity separator will separate seeds of the same size and of different densities. It also will separate seeds of the same density and different sizes. The separation of seed of various sizes and different densities is not practicable with this device.

Indent Cylinder Separator

The indent cylinder separator performs separation by taking advantage of differences in the length of the seeds. It has a horizontal rotating cylinder and a movable separating trough. The inside surface of the cylinder has small closely spaced, semi-spherical indentations. When a mixture of seed is passed into one end of the cylinder, shorter seed is

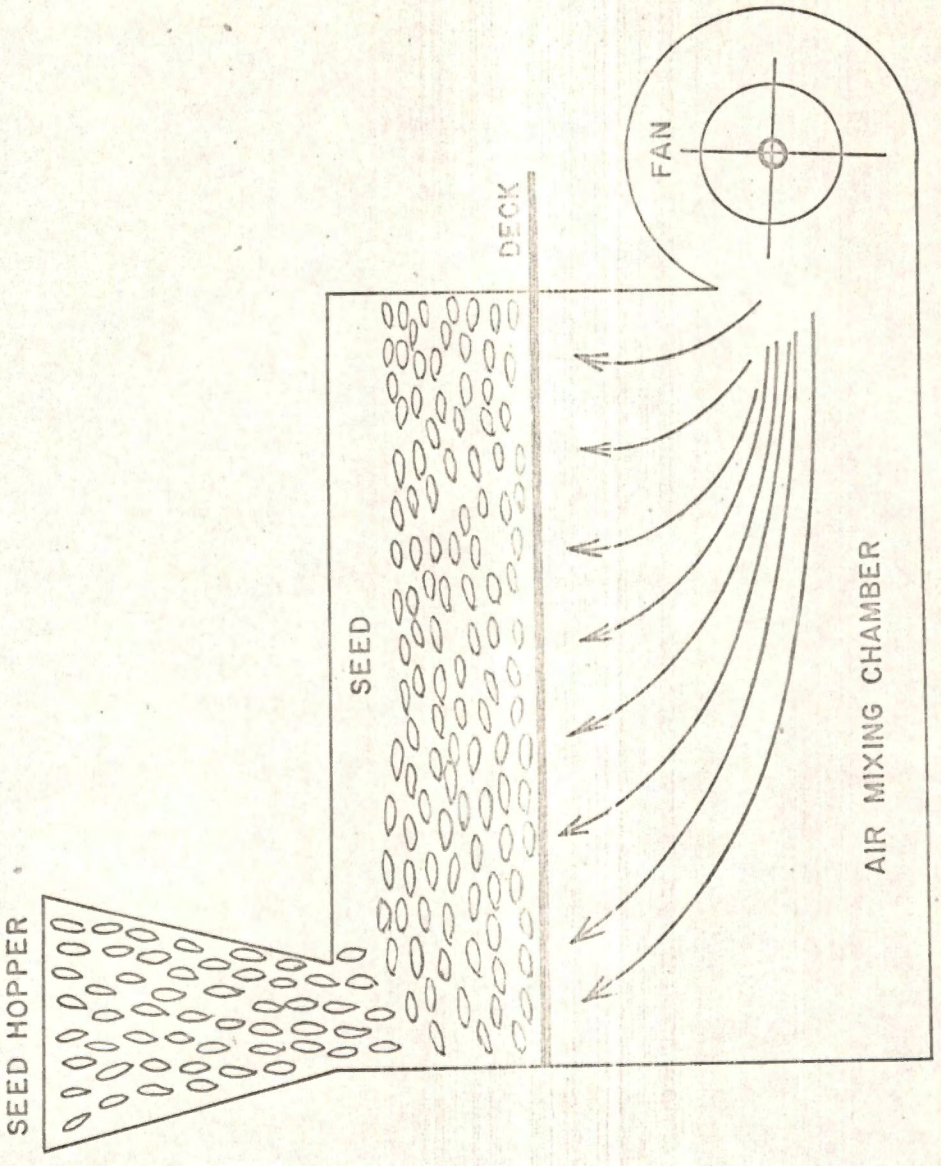


Figure 7. Sectional View of Gravity Table

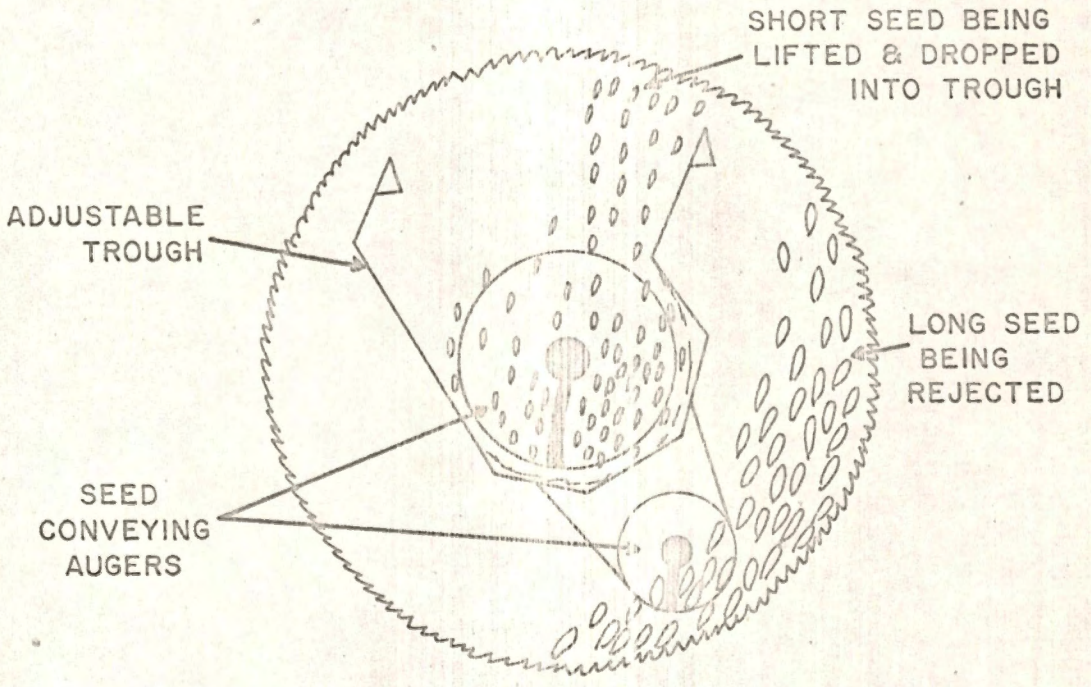


Figure 8. Cross Section View of Indent Cylinder Separator.

lifted by the combined effect of fixture of the indents and centrifugal force. Near the top of the rotation, it drops into an adjustable trough inside the cylinder. A spiral conveyor in the bottom of the trough moves the lifted material to the end where it is discharged. Thus separation between the shorter weed and longer desired crop seed is achieved.

Other Information Concerning the Cleaning Process

Seed first normally goes through a precleaning operation which may include scalping, scarifying, and removal of awns if the seed is of awned varieties and kinds. The seed may then be passed into an air screen cleaner where the bulk of foreign material is removed. The final separation is made on one or more finishing machines which generally separate only a desired type of contaminating seed from the cleaned product. Besides those mentioned above, there are indent disc and cylinder separators, pneumatic and aspirator separators, velvet roll separators, spiral inclined draper separators, electronic separators, and magnetic separators which effect the cleaning process based on different physical characteristics of the seeds of different crops.

Seed Treatment. Seed treatment is found to be essential to the protection of seed from soil and plant borne fungi and insect damage before it goes into the warehouse. Treated seed has been shown to result in increased yields, and seed treatment equipment is now considered as an essential stage of seed processing.

Seed treaters are of three main types: dry powder applicators; slurry applicators, and liquid applicators. Based on needs in Madras

State, the slurry applicator is suggested since it is satisfactory under tropical conditions. A treatment of Agrosan G.N., a mercuric compound, at the rate of one ounce per 60 pounds of seed, is generally recommended.

Plant Layout. Many factors are considered in designing the seed processing plant. The suggested plant layout plans given on pages 78 and 79 illustrate this fact. The handling and cleaning of seed should be made possible without mixing or damaging it and with a minimum allocation of adequate equipment, personnel, and time. The seed separators, elevators, conveyors, and storage bins should be so designed and arranged that seed can flow continuously from beginning to end; yet they should be flexible enough to bypass a given machine or return part to it for re-cleaning. The commonest plant layout is the multi-story design in which machines are placed in a vertical processing line and seed flows by gravity from one to the next. Single story plants are often considered because of the reduced cost of construction, lower labor requirements, and need for special processing of certain crops. When a seed lot for cleaning arrives at the plant, a sample is first analyzed to determine which machine or machines will be used. The separator selected generally is the one that will remove the greatest amount of contaminating material with the smallest loss of the crop seed.

Working of Machinery. Upon being received from the fields, seed is dumped into the truck dump from which it is lifted to the drying bin by elevator. Here the seed is dried to the required moisture level and passed on to the clipper cleaner. In the plant layout plans (in page 78),

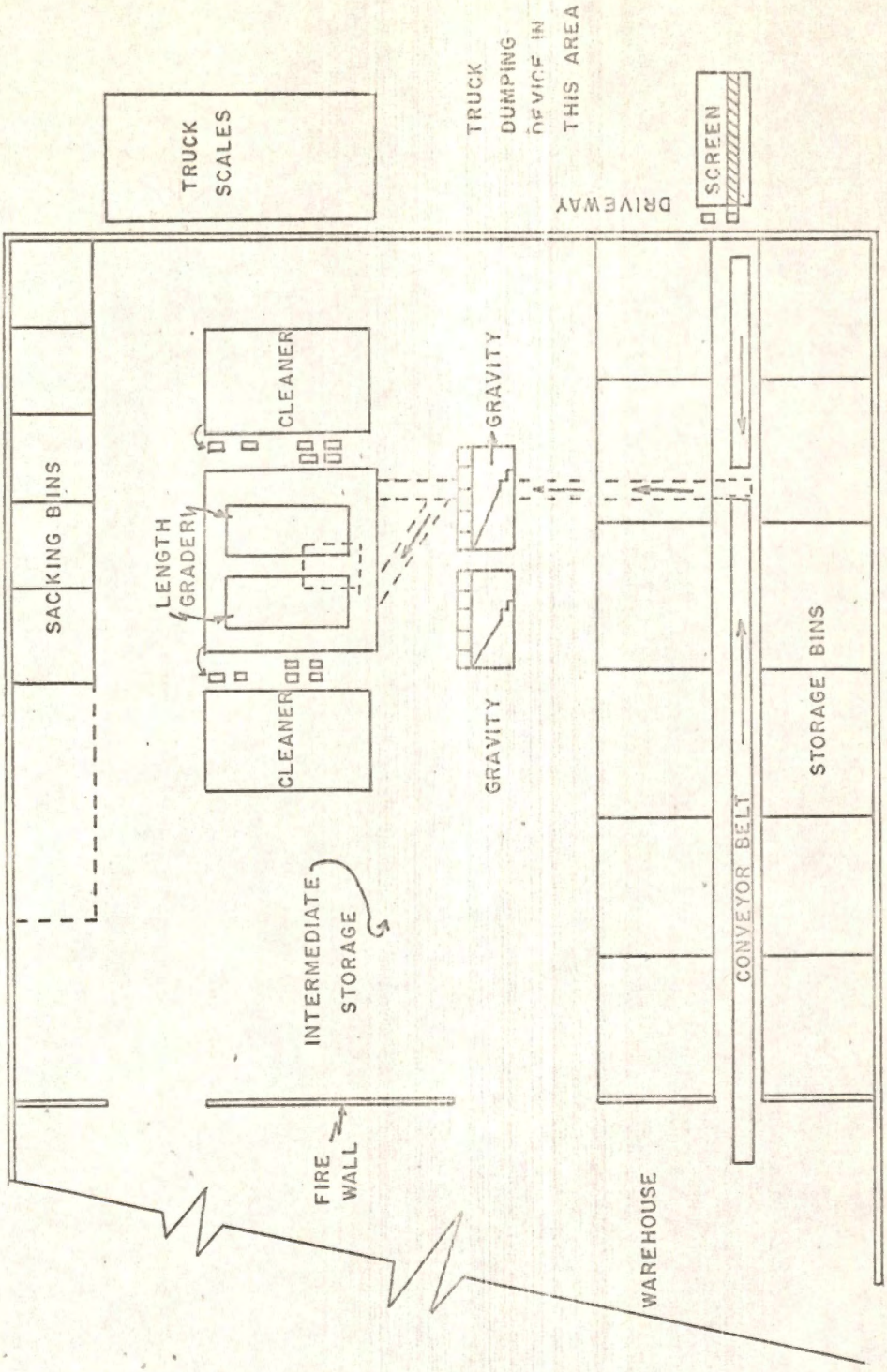


Figure 9. Floor Plan of Proposed Seed Processing Plant.

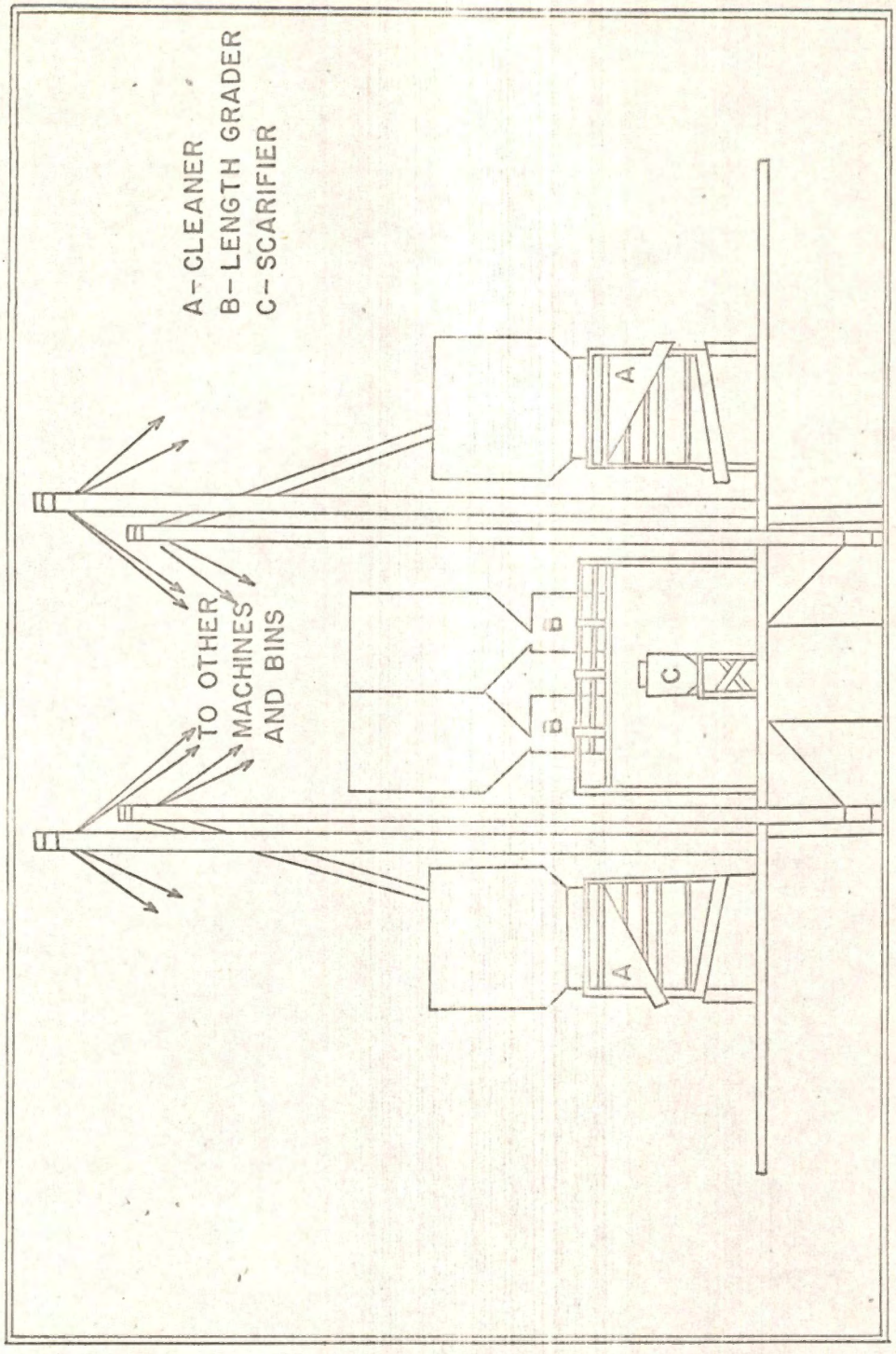


Figure 10. Elevation View of Proposed Seed Processing Plant.

two symmetrical portions of the machine are shown. The seed is separated by size and weight in the clipper cleaner and passed on to length graders which are known as corded discs. Corded discs separate by length and separate shorter grain from longer grains. The seed next passes to the gravity separators where light weight seed is separated from heavy seed by floatation. Here faulty grains, like damaged or half-grains, are driven out, and the solid pure seed is sent on for deposit in the storage bins by means of elevators.

B. CAPACITIES OF THE PROCESSING PLANTS

A total number of 11 crops has been considered for seed processing in the state. The details of crops and areas may be found by referring to Table V.

Capacities suggested for each plant were determined after studying the extent of the given crop area, the nature of the crops, harvest times, and other requirements of the crops in the region. The seed rate multiplied by the area gives the quantity of seed to be processed in a plant. The seed under question is presumed to be supplied by the State Seed Farms, Agricultural Cooperative Production Societies, and private farmers who meet the seed certification specifications established.

Some significant differences among the various processing plants should be here noted. Rice and groundnut are grown in all four regions of the state. In the deltaic regions of Tanjore and Tiruchirapalli districts, rice, groundnut, and pulses are grown in large concentrated areas. Other crops in this latter region are insignificant, and this was

TABLE V

SUGGESTED CAPACITIES OF SEED PROCESSING PLANTS IN MADRAS STATE ACCORDING TO MAJOR CROPS AND TOTALS

Crop seed processed	Chingleput Plant (000's Lbs)	Coimbatore Plant (000's Lbs)	Tiruchira-palli Plant (000's Lbs)	Madurai Plant (000's Lbs)	Total (000's Lbs)
Rice	30,000	30,000	30,000	30,000	120,000
G.nut	25,000	25,000	25,000	25,000	100,000
Sorghum	--	10,000	--	10,000	20,000
Cumbu	1,250	1,250	--	1,250	3,750
Ragi	1,250	1,250	--	2,500	5,000
Tenai	--	--	--	250	250
Wheat	--	240	--	--	240
Pulses	1,500	2,625	750	750	5,625
Gingelly	500	--	--	500	1,000
Chillies	15	30	30	75	150
Coriander	--	250	--	250	500
Total	59,515	70,645	55,780	70,575	256,515

considered in suggesting the relatively low capacity of the Tiruchirapalli processing plant, whereas the Madurai and Coimbatore plants would be designed to handle almost all varieties of seed. The details of crops, areas, seed rates, and seed requirements for the respective plants are given in Appendix B.

Seasonal Work Loads

The work loads of the processing plants will depend upon the harvesting periods of the crops, there being three distinct seasons of harvest in case of single crop alone, rice. The main crop is harvested during the months of February and March. About one-quarter of the area is double cropped and harvested in July and December. Groundnut is harvested twice a year, in April and September. Other millets and pulses are harvested in April, May, and September. Therefore, the processing units are expected to be operating at full capacity during 6 months in a year, March, April, May, July, September, and December. The rest of the months they will be engaged in upkeep and other phases of the work. This variation of load demand was considered in estimating the suggested capacities for the plants.

C. PROCESSING PLANTS FOR THE STATE SEED CORPORATION

As per the study of crops under each region, it was envisaged to set up seed processing plants of the following capacities:

Chingleput	59	Million pounds of seed per year
Coimbatore	71	" " " " " "
Madurai	71	" " " " " "
Tiruchirapalli	56	" " " " " "
Total	257	" " " " " "

The processing plant at Tiruchirapalli was selected for a detailed cost analysis of seed processing.

Cost of Processing of Seed at Tiruchirapalli

The proposed plant at Tiruchirapalli would have a capacity of 150 bushels per hour. This capacity is an optimum unit for the machinery recommended by the managers of processing plants studied in Tennessee. It also was suggested that if and when the seed processing plant reaches its maximum expected annual capacity of 56 million pounds, a smaller unit may be added advantageously. Therefore, the following discussion will be concerned with machinery that will yield a capacity of the peak 150 bushels per hour. The processing unit is intended to work 16 hours a day in two shifts for an annual 48 weeks of 5 1/2 days per week. This would produce a total of 38 million pounds of processed seed per year. Floor space of the plant was divided between machinery and storage space for seed.

Processing Machinery. Processing machinery will consist mainly of a drier and a clipper cleaner. There also will be a gravity table, seed treating device, and automatic scale and sewing machine. A moisture-testing machine will record moisture at the time of receiving the seed

and during processing, and take the final moisture content before bagging. Table VI presents details of an estimate of the cost of the necessary machinery.

Building. The processing plant will be a one-story, concrete block building with concrete flooring, walls, and steel scaffoldings covered with corrugated zinc sheetings. This is the common type of seed processing building constructed for most industries in the state. The building should be of 80' x 260' dimensions, giving a floor space of 20,800 square feet. Machinery will occupy approximately 800 square feet, while the other 20,000 square feet is intended for storage in passageways.

An office space for supervisory staff will be located in a building of 20' x 10' dimensions adjacent to the processing plant.

An estimate of the cost of the processing machinery and buildings was established from the suggestions of the plant managers and comprehensive study of the different processing plants in Tennessee. Table VII presents details of the estimate for the cost of buildings of the proposed seed processing plant at Tiruchirapalli, and Table VIII presents the estimate of capital investment for the proposed plant.

Fixed and Variable Costs. The fixed costs of the processing plant include interest, depreciation, repair, maintenance, taxes, and insurance. These costs are considered as fixed and independent of volume of seed handled in any plant in the state.[5]

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[5]U.S. Department of Agriculture, Cost Rates on Building and Equipment, Market Research Report No. 400 (Washington, D.C.: USDA), p. 19.

TABLE VI

ESTIMATED COST OF PROCESSING MACHINERY FOR THE PROPOSED SEED PROCESSING PLANT AT TIRUCHIRAPALLI*

Machines Considered	H.P. Rating	Processing Capacity Bushels of Seed per Hour	Cost ($)	Explanatory Remarks
CAMPBELL Drier	10	200-300	5,000	This drier is necessary for 150 bushel per hour processing
SUPER X 298 Clipper Cleaner	10	150	3,200	
Installations, elevators, motors, and other auxiliary equipment			3,200	Installations and auxiliary equipment cost will equal the cost of the Clipper Cleaner
HART-CORTER discs 2 No.s 3324 Numbers 2 2 H.P. each	4	150	4,000	
Gravity table	10	150	2,000	
Seed treater	1	150	1,000	
Automatic scale	--		2,200	
Moisture tester	--		500	
Sewing machine and bag closer	--		250	
Screens for cleaners 50 numbers	--		1,250	
Total	35		22,600	

*Plant total average processing capacity would be 150 bushels of seed per hour.

TABLE VII

ESTIMATED COST OF BUILDINGS FOR THE PROPOSED SEED PROCESSING PLANT AT TIRUCHIRAPALLI

Building Considered	Amount ($)
Office building 20' x 10' (200 sq. ft. at $3/-sq. ft.)	600
Processing plant and storage 260' x 80' (20,800 sq. ft. at $3/-sq. ft.)	62,400
Total	63,000

TABLE VIII

ESTIMATE OF CAPITAL INVESTMENT OF THE PROPOSED SEED PROCESSING PLANT AT TIRUCHIRAPALLI IN DOLLARS AND RUPEES

Investment Item	Amount ($)	Amount (Rs.)
Lands (2 acres at $500/-per acre)	1,000	4,750
Buildings (21,000 sq. ft. at $3/-per sq. ft.)	63,000	299,250
Processing machinery (including moisture testing machine)	22,600	107,350
Furniture and Fittings (tables, chairs, racks --- approximate)	1,000	4,750
Total	87,600	416,100

The building depreciation rate for the plant and storage is calculated at 3 per cent per year with the assumption that the building lasts 33 1/3 years.

For repairs and maintenance, 1 per cent of the initial investment in buildings and 10 per cent of depreciation of processing machinery were considered adequate. The processing plant and storage would be subject to local taxes. The municipal taxes in most urban areas of the Madras State are collected half yearly, and a maximum tax of Rs. 100/-per half year on buildings and machinery combined was therefore included in the fixed annual costs. Insurance rates for fire and other clauses are presumed to be 1/2 per cent of the investment on buildings and machinery. Tables IX, X, XI, and XII present the details of estimated annual fixed costs on lands and buildings, estimate of annual fixed costs on machinery, total annual fixed costs of the proposed seed processing plant at Tiruchirapalli, in United States dollars and Indian rupees.

Electric motors would be used for running the machinery. Lighting and water supply expenses were considered. Fuel oil was expected to be consumed at 1 gallon per 100 bushels of seed dried by the drier. The cost of the electricity for industrial purposes varies from 9 Np. to 15 Np. For this estimate, a flat rate of 10 Np. per kilowatt hour energy consumed was adopted.

Supervisory Establishment

The proposed Madras State Seed Corporation will have four regional offices each with a processing plant, and a main office situated in the state capital, Madras City. The suggested staff both at the regional

TABLE IX

ESTIMATE OF ANNUAL FIXED COSTS ON LANDS AND BUILDINGS OF THE PROPOSED SEED PROCESSING PLANT AT TIRUCHIRAPALLI IN DOLLARS AND RUPEES

Cost item	Amount ($)	Amount (Rs.)
Interest on land value at 6% on $1,000 per annum	60	
Tax at $2/-per acre per annum	4	
	64	304.00
Buildings		
Interest at 6% of 1/2 of initial investment ($63,000 x 1/2 x 6/100)	1,890	8,977.50
Depreciation (3% of initial investment)	1,890	8,977.50
Taxes ($20 x 2)	40	190.00
Maintenance and repair at 1%	630	2,992.50
Insurance (1/2%)	315	1,496.25
Total	4,829	22,937.75

TABLE X

ESTIMATE OF ANNUAL FIXED COSTS ON MACHINERY OF THE PROPOSED SEED PROCESSING PLANT AT TIRUCHIRAPALLI IN DOLLARS AND RUPEES

Cost item	Amount ($)	Amount (Rs.)
Interest 6% of 1/2 of initial investment (22,600 x 1/2 x 6/100)	678	3,220.50
Depreciation at 10% on $22,600	2,260	10,735.00
Taxes ($20 x 2)	40	190.00
Insurance (1/2% on $22,600)	113	536.75
Maintenance and repair (5% on $22,600)	1,130	5,367.50
Total	4,221	20,049.75

TABLE XI

TOTAL ANNUAL FIXED COSTS OF THE PROPOSED SEED PROCESSING PLANT AT TIRUCHIRAPALLI IN DOLLARS AND RUPEES

Cost item	Amount ($)	Amount (Rs.)
Land	64	304.00
Buildings	4,765	22,633.75
Machinery	4,221	20,049.75
Total	9,050	42,987.50

TABLE XII

ESTIMATED ANNUAL VARIABLE COSTS OF THE PROPOSED SEED PROCESSING PLANT AT TIRUCHIRAPALLI IN DOLLARS AND RUPEES

Cost item		Amount ($)	Amount (Rs.)
ELECTRICITY			
Electricity for power 35 H.P.--1 H.P.--1.34 Kilo-watt, 16 hours per day at 10 Np. per Kilo-watt hour for 264 days	Rs. 11,032.86		
Lighting at Rs. 5/-per month for 12 months	60.00		
Water motor charges at Rs. 2/-per month for 12 months	24.00		
	Rs. 11,116.86	2,340.39	11,116.86
FUEL OIL			
Fuel oil for drying at 1 gallon for 100 bushels of seed at Rs. 1.50 per gallon		2,000.84	9,504.00
LABOR			
Laborers at 4 persons per shift of 8 hours for 2 shifts 8 men wage rate at Rs. 75/-per man 75 x 8 x 12		1,515.76	7,200.00
SPARE PARTS			
Approximate value of spare parts		500.00	2,375.00
Total		6,356.99	30,195.86

offices and main office will be drawn from the Madras State Department of Agriculture and are conversant with the several factors involving high quality seed production. An adequate knowledge of accounting systems followed in corporate bodies and the procedures involving the cooperation of farm leaders and people's representatives on the board is prerequisite for entrusting the duties of the corporation to the personnel of the Agricultural Department, both at regional processing plants and at the main office. It is presumed an officer in the rank of Deputy Director of Agriculture may function as a general manager at the main office, while the district agricultural officers could be assigned the duties of regional plant managers. An assistant agricultural engineer will be responsible for engineering problems of the four regional plants and will work under the supervision of the general manager of the State Seed Corporation. Salaries of the subordinate staff and other expenditures such as stationery and postage have been considered. A recurring annual expenditure of Rs. 8,750 is expected to be borne by each regional plant towards the share of main office expenditures. All matters pertaining to policy, direction, and financial sanctions will have to be decided by the main office taking into consideration the respective regional requirements. Table XIII presents the details of expenditures for the suggested supervision of the proposed processing unit at Tiruchirapalli. The details of expenditures that may be incurred by the main office are presented in Appendix D.

The Estimated Annual Costs and Income

The annual fixed and variable costs of the processing plant,

TABLE XIII

ANNUAL ESTIMATE OF SUPERVISORY CHARGES AT THE PROPOSED PROCESSING UNIT AT TIRUCHIRAPALLI IN DOLLARS AND RUPEES

Charge item		Amount ($)	Amount (Rs.)
PLANT MANAGER			
Pay and allowances at Rs. 500 x 12	Rs. 6,000		
OFFICE			
Clerks 2+1			
2 x 140 x 12	3,360		
1 x 110 x 12	1,320		
Allowance 60 x 3 x 12	2,160		
Last grader 1 x 100 x 12	1,200		
Foreman 1 x 200 x 12	2,400		
	Rs. 16,440	3,460.21	16,440
STATIONERY 25 x 12	300		
POSTAGE 25 x 12	300		
MISCELLANEOUS 50 x 12	600		
	Rs. 1,200	252.65	1,200
Share of Head Office expenses vide Appendix D.			
35,000 /4 =	Rs. 8,750	1,842.10	8,750
Total		5,554.96	26,390

storage, and supervisory office at Tiruchirapalli includes the annual fixed costs on land, buildings, and machinery, and variable costs are considered for the use of electricity, fuel oil, and water in running the processing plant. Labor costs and supervisory charges are included in arriving at the total annual fixed and variable costs of the processing plant. Table XIV presents the details of the above cost items.

The approximate turnover of the seed per annum has been estimated at 38 million pounds. Cost of processing of 100 pounds of seed is estimated to be $ 0.053 (U.S. currency) or Rs. 0.125. A 50 per cent margin over the processing cost is suggested which accrues $ 9,880 or Rs. 47,500, and is expected to meet central and state taxes, reserve fund and dividend requirements. Table XV presents the details of estimated annual costs and income of the proposed processing plant at Tiruchirapalli.

Problems in the Cost Study. A cost study of the proposed seed processing plant presented problems in arriving at various expenses under fixed and variable costs. The processing method is not the same for all crops. It is presumed that by considering the weight of the seeds that this error will be minimized. The losses of grain due to moisture, dirt, and inert matter will be determined by the processing of random samples of at least 1,000 pound lots; and the approximate deductions from the raw grain to be received by the processing plant will be worked out. This consideration is highly significant since it concerns both the farms and processing units. The loss of seed both in weight and volume should be ascertained in final fixation of the price of seed. The income from screenings, which is a basic ingredient in feeds, should also be

TABLE XIV

ABSTRACT: ESTIMATE OF ANNUAL FIXED COSTS AND VARIABLE COSTS OF THE PROPOSED PROCESSING PLANT AT TIRUCHIRAPALLI IN DOLLARS AND RUPEES

Cost item	Amount ($)	Amount (Rs.)
FIXED COSTS		
a. Land and buildings	4,829.00	22,937.75
b. Machinery	4,221.00	20,049.75
VARIABLE COSTS		
a. Electricity	2,340.39	11,116.86
b. Fuel oil	2,000.84	9,504.00
c. Labor	1,515.76	7,200.00
SUPERVISORY CHARGES		
Processing plant and share of Head Office expenses	5,554.96	26,390.00
Total	20,461.95	97,198.36

TABLE XV

ESTIMATED ANNUAL COSTS AND INCOME OF THE PROPOSED PROCESSING PLANT AT TIRUCHIRAPALLI IN DOLLARS AND RUPEES

Cost or imcome item	Amount ($)	Amount (Rs.)
Approximate turnover of seed per annum:		
150 x 16 x 264 x 60 = 38,016,000 pounds or 38 M.Lbs.		
Expenses for processing above seed	20,461.950	97,198.360
Expenses for processing 100 pounds of seed	0.053	0.250
Add:		
50% as margin over cost of processing 100 pounds of seed	0.026	0.125
Earnings		
Gross earnings of the processing plant per annum:		
For 38,000,000 pounds of seed	9,880.000	47,500.000
Net earnings of the plant (annual)	9,880.000	47,500.000
Net percentage of profit	11.270	11.270
Items for consideration for distribution of the profit:		
a. Dividend		
b. Taxes on earnings		
c. Reserve Fund		

considered. The seed is to be supplied in gunny sacks with labels and seals. This cost should be considered in the pricing, and should be recovered from the agricultural depots.

An important item to note is the margin of Rs. 0.125 per 100 pounds of seed (see Table XV), which is not much under Madras conditions. No farmer would grudge to pay this small amount in return for the quality of seed that will be supplied to him.

D. STORAGE OF PROCESSED SEED AND DISTRIBUTION

Seed Handling Devices

Seed handling devices suggested in this study include bucket elevators and self-cleaning vertical elevators which carry and bring back seed after processing from various units. A crew of four laborers who would work in each of two shifts would be employed for stacking and arranging various lots of the seed. It is to be recognized that, during peak seasons, situations may arise that call for more labor, and this addition should be considered in assessing variable costs.

Packaging

Modern packaging uses many methods and materials to preserve seeds at their original quality from the time they are processed to the time they are planted. Many kinds of dried seeds of 3 to 8 per cent moisture maintain good viability and vigor if they are stored in moisture-proof containers. Packages for processed seed are made from burlap (jute), cotton, cloth, paper, other fibers, metals, glass, fiber-board, and

various combinations of such materials.[6] Jute is a low-cost fiber woven of good quality jute yarn and is strong in tensile strength and tear resistance. Jute bags are therefore suggested which can stand stacking in storage and withstand rough handling. Some types of laminated burlap bags that would retain the gases used for fumigation and seed treatment might be considered for storage of particular seeds.

Labeling

All seed sold by the Madras State Seed Corporation must have an official tag and seal properly fixed to each bag of seed. The label should indicate information regarding name of variety, official laboratory analysis, corporation trade mark, lot number, germination percentage, and the time limit until which the seed is fit for sowing. Seal or tag should be so affixed that it prevents tampering. The specifications of labels, seals, and trade marks should meet the set requirements of state and central seed laws.

Storage

Proper storage of seeds plays a very significant role in the development of orderly distribution and viability maintenance of certified seed. The agricultural depots in the Community Development Blocks are currently faced with a serious shortage of floor space available to stock seeds until delivered to farmers. Therefore, adequate storage

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[6]Louis N. Bass, Te May Ching, and Floyd L. Winter, Seeds, Year Book of Agriculture, 1961 (Washington, D.C.: U.S. Department of Agriculture, 1961), p. 330.

facilities at each regional processing center are necessary. This reduces cost of handling and movement and ensures safety against loss by depredation of insect and disease pests.[7] The most economical handling of bulk seeds requires adequate storage facilities to be provided, and these facilities should be accessible to the receiving and processing equipment. Provision is made for 20,000 square feet of space in the processing plant described, and this space should meet the storage requirments of both unprocessed and processed seed. Further studies under tropical conditions regarding moisture content, storage temperature, length of storage period, and type and amount of fumigants, like carbon disulphide, ethylene dibromide, and methyl bromide, should be undertaken, and uniform standards should be made available for reference and compliance. Some of the improved storage practices under study in the United States are:

1. Storing of dry seed in dehumidified warehouses

2. Packing of and in moisture-proof, elastic paper bags, plastic bags, wax paper bags, and boxes

3. Packaging of and in hermetically-sealed containers for maintaining low seed moisture

4. Refrigerated seed storage, storage with fumigants, and storage after irradiation of seeds (X-ray, Gamma ray, or cathode ray for controling microorganisms).[8]

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[7]Indian Council of Agricultural Research, New Delhi, Hankbook of Agriculture, 1961 (New Delhi, India: Indian Council of Agricultural Research, 1961), p. 625.

[8]Dr. Te May Ching, Crops and Soils, 1959, Vol. XI, p. 16.

All the above methods deserve experimentation under tropical conditions to choose the most suitable ones. Until new safe methods are determined, packaging in jute bags and stacking in fumigated storage areas appear to be relatively safe and economical practice.

Transportation

The seed is to be transported from State Seed Farms and other farms engaged in certified seed production by engaging trucks operated by private transport companies and individuals. The seed may be packed in second-hand sacks and delivered to the processing plants. Once the seed reaches and is accepted by the corporation seed processing plant, the responsibility for further handling lies with the plant. The processing centers are so chosen as to afford maximum transport facilities to all corners of the state by rail and truck, minimum distance being considered based on present rail and road networks. In the case of Chingleput District, canal transport is available for a distance of about 60 miles by the Buckingham Canal. The country craft operated on the canal may be utilized to transport seed to the coastal parts of the district.

The possibility of owning a fleet of trucks by the State Seed Corporation and the relative economics involved should be explored. As a start, a uniform mileage rate per 100 pounds per mile can be worked out with existing transport companies. The transport charges from the processing plant to the agricultural depot should be allocated to the latter as per the quantities of seed supplied.

Seed Legislation

Seed legislation in center and state is currently not adequate to introduce such a comprehensive certified seed program. Legislation has been passed in some states in India encouraging the use of improved seed. The Punjab Improved Seeds and Seedlings Act, 1950, and the Hyderabad Improved Seeds and Seedlings Act, 1950, are some examples which provide for use of improved seed, recommended by the State or Central Agricultural Department.[9] However, uniform laws both at center and Madras State levels with strict regulations on seed movement and enforcement of uniform standards throughout the country is the immediate necessity before launching a seed certification program in the state.

Madras State seed legislation should include penalties against false labeling, improper seed movement, and wrong declarations. State legislation should authorize the establishment of the State Seed Certification Board, State Seed Corporation, and a State Seed Laboratory as a step towards increasing the food production in the state.

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[9]Indian Council of Agricultural Research, Handbook of Agriculture, 1961 (New Delhi, India: Indian Council of Agricultural Research, 1961), p. 634.

CHAPTER V

SUMMARY AND CONCLUSIONS

A. SUMMARY

Seed occupies an important place in the production plans of an individual farmer or a group of farmers within a country, state, or an entire nation. Seed is especially significant in a country like India where the other production factors such as fertilizers, irrigation, and plant protection chemicals are limited. The contribution of high quality seed in increasing food production is undoubted. The phenomenal growth of population demands an ever increasing food supply for the teeming millions. It is considered that a modest increase of 10 per cent, by means of superior quality seed, should be given the highest consideration in planning the economy of the country. Adoption of a plan such as outlined in this thesis should aid in partial solution to a food problem such as this.

This seed problem has confronted the author several times during his duties as Agricultural Demonstrator in Taluks, and later as Agricultural Extension Officer in Community Development Blocks in the Madras State Department of Agriculture. Often times it became a perpetual wonder to comprehend, as to who else might be more responsible to the farmer in a Welfare State like India than the representatives and members of the Agricultural Department in the various Developmental Blocks who are supposed to help the farmer with technical knowledge, material, and time to promote more production. This study was a conscious effort to

understand the magnitude of the seed problem in Madras State and to devise proposable ways and means to extend the benefits of research in the field of seed development to the farmer. The seed requirements based on crops under cultivation in the different districts in Madras State, rainfall, soil, and topography all were considered. On the strength of valuable seed selections made in different research stations in the state and availability of improved quality seed in the form of nucleus seed in the Agricultural Research Stations in the state, success of proposed efforts on this agronomic side of correcting the food problem have an excellent chance of success.

Additional factors introduced in the study were suggestions for the participation of farm leaders genuinely interested in the welfare of the rural community in all its facets, and for the coordination of the activities of the State Department of Agriculture in setting up specific bodies and involving farm interests, in order to guide them to learn to help themselves. This, in short, was a comprehensive approach to coping with the seed problem. Study of successful seed programs in the United States served as a basis for formulating a proposed seed plan for Madras State.

The unique position of seed technology, seed production, certification programs, and marketing in the United States is not an unexplainable achievement in the field of agricultural development. Ever since passage of the first Morrill Act in 1862, Land Grant Colleges have been imparting practical knowledge in agriculture, and the search for superior seed has received the constant attention of the agronomists throughout

the country. The introduction of seed certification programs early in 1920 in several states and the establishment of the International Crop Improvement Association, resulted in much desired coordination in furthering the cause of seed production. Today, the seed industry occupies a significant place in the economy of the United States. About 150 different kinds of agricultural seed are produced, valued at more than 300 million dollars.[1] (This does not include vegetable and flower seeds.) Therefore, the success of methods adopted in the United States in accomplishing such phenomenal progress in seed development should deserve serious study and consideration in the development of a like system in India. Most of the states have comprehensive seed programs in operation in the United States. Seed programs in Tennessee provided practical examples for this study.

The Tennessee Crop Improvement Association has responsibility to enforce seed standards in the state. The membership, though mainly seed growers, includes representatives of the Land Grant College, University of Tennessee, Agricultural Experiment Station, and State Department of Agriculture. The participation of the United States Department of Agriculture is achieved by representing Land Grant College in the association. A similar organization is suggested for use in Madras State in the form of a proposed Madras Seed Certification Board. The similarities of the board and the Tennessee Crop Improvement Association consist mainly in

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[1]J. E. Harmond, N. R. Bradenburg, and D. E. Booster, "Seed Cleaning by Electrostatic Separation," Journal of the American Society of Agricultural Engineers, Vol. XLII (Michigan, January, 1962), pp. 22-25.

the participation of farm leaders, officers of the State Department of Agriculture, representatives of the College of Agriculture and Research Institute on a purely voluntary basis for the benefit of seed improvement. Both would be legalized bodies charged with seed law enforcement in the respective states. Both would be service organizations financed through service fees charged to farmers for the services rendered.

The chief difference between the Tennessee Crop Improvement Association and the proposed Seed Certification Board in Madras State exists in the decentralized activities of the board into three levels, at state, district, and Taluk, and thus aims at maximum cooperation and representation of the farmers at all stages. A significant advantage of the Madras Seed Certification Board would be the presence of a large number of State Seed Farms engaged in improved seed production. It is presumed that enforcement of seed standards in a systematic and thorough manner could be made possible on these farms. The difficult task that faces the board is the absence of uniform seed standards in the state or in the country as a whole. It is worthwhile to note that utmost benefits will result if similar organizations are established in every state in India with necessary cooperating seed legislation and standards.

The Madras State Seed Corporation would be conceived to function as a trading organization. The importance of this organization is no less than that of the Seed Certification Board for providing certified seed to the farmer. Four processing plants with 20,000 square feet of storage for each plant will operate at Chingleput, Tiruchirapalli, Madurai, and Coimbatore. The Tiruchirapalli plant and storage will

provide central storage where excesses or shortages from the other centers can be adjusted. The seed produced on the State Seed Farms, cooperative societies, and the farmers' fields situated in the respective regions form the material for processing and storage. The processed seed will be bagged, stored, and distributed to the agricultural depots in the Community Development Blocks for sale to the farmers. The seed standards set by the State Seed Certification Board will be enforced at all stages of production, processing, storage, and distribution. Efficiency and economy will be aimed at in suggesting the above functions by means of employing optimum supervisory staff and the latest machinery. As an example, it is expected to cost not more than Rs. 0.50 (10 cents in United States currency) per 100 pounds for all operations including margin of the processing plant, which is highly reasonable in consideration of the actual cost and value of the seed. This small sum would guarantee pure, high-quality seed as per the needs of the farmer, and sustain a great organization found solely for the protection of seed interests in the state.

The seed processing unit would be a new venture in India. But the fact that the introduction of other agricultural machinery, such as oil engines and electric motors, pumpsets, tractors, bulldozers, power sprayers, and other machinery, has met with practical utility and success during the last two decades or more would support the assumption that adequate seed processing machinery would be readily accepted.

No wholesale mechanization in the seed processing setup is suggested at this stage because of the continued need for jobs for labor.

Machinery is suggested so far as it would serve as a complementary factor to human and cattle labor. The different machines, such as driers, clipper cleaners corded discs, gravity separators, and moisture meters, have been included after visiting a number of efficient processing plants and discussing relative advantages with the persons in charge of such processing units. Care is taken to suggest use of the latest mechanical advantages available in selecting the machinery. It is presumed that with suitable screen adjustments, most of the grains, beans, and other seeds could be processed effectively. Economy, uniformity, speed, and high quality turnover have been considered as guiding factors in suggesting the machinery.

The processing unit, for example, at Tiruchirapalli will have a capacity of 150 bushels per hour processed seed. The unit is expected to cost about $22,600. The buildings for the location of the machinery, office space for supervisory staff, and storage are estimated to cost about $63,000. The annual fixed and variable costs and management salaries are expected to cost Rs. 97,298.36 or $20,461.95, and a total quantity of 38 million pounds are expected to be processed, working two shifts of 8 hours a day for 48 weeks of 5 1/2-day weeks. The processing cost works out to Rs. 0.25 (5 cents in United States currency) per 100 pounds of seed, which is not high for the approximate value of Rs. 20/- per bag of 100 pounds of seed.

The storage space of 20,000 square feet proposed at each processing unit is expected to meet all storage requirements in all seasons and conditions. The methods of packing, labeling, and transporting also were considered briefly.

B. CONCLUSIONS

Seed legislation deserves immediate attention as a prerequisite for implementing an adequate seed program in the state. Legislation in India has covered several aspects of farm life, such as farmers' rights to land, liquidation of intermediary ownership, crop protection, debt relief, cooperative farming, and various other items. Due to historical reasons, the legislation could not be uniform in all the states, and neither is it adequate in all its coverage. Seed legislation is one such field which requires immediate action. Caution should however prevail as to what exactly the goals and objectives are and how the legislation is expected to realize the purposes. Dr. A. S. Carter, Seed Commissioner of the State of Indiana, in his capacity as Seed Consultant to the Government of India, stressed the importance of seed legislation embodying seed standards, seed certification, seed movement, and control.[2] Such legislation is an immediate necessity and would make it possible for the suggested seed plan to be put into operation in Madras State.

Seed standards form the sole basis on which seed descriptions, technical, legal, trade, and common terms will have meaning and application. There is no dearth of terms or standards in the country. The thorough examination, recognition, and acceptance among the states will help dispel doubts, variations, and confusion.

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[2]Dr. A. S. Carter, "Progress in the Seed Improvement Program in India, 1961" (New Delhi: United States Agency for International Development, 1961), p. 4. (Mimeographed.)

Training in seed technology as specialized seed science should be made available to all personnel connected with various stages of seed handling. A refresher course covering morphology, physiology, histology, breeding, seed processing, and storage is desirable for all agricultural graduates engaged in seed production, processing, and marketing. Intensive training in identification and determination of seed characteristics, such as variety, purity, germination, inert matter, and moisture, may be found essential for the laboratory seed technicians.

Implementing the seed program in two or three stages may be more desirable. The operating of one processing plant at one of the centers, for example Tiruchirapalli in this study, may help to gain experience and operation can be subsequently extended to other centers.

Seed technology is one of the fast-developing sciences. It is not worthwhile for any country to lag behind in the field and thus fail to bring home the fruits of research to the farmer. An active participation in International Associations will help to remedy the situation. The Food and Agricultural Organization at Rome, Italy, has done yoeman service in focusing attention on the importance of seed, by initiating a World Seed Campaign in 1958.[3] Several countries have awakened to the necessity of developing seed resources in their respective countries and have organized National Seed Campaigns. The International Crop Improvement Association, the International Seed Testing Association, and the

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[3]Food and Agricultural Organization, Rome, Italy, World Seed Campaign News, Vol. XV (Rome, Italy: Food and Agricultural Organization, April, 1962), pp. 6-12.

Food and Agricultural Organization of the United Nations are constantly striving to improve the seed situation in the world. The benefits that can result in participation of such bodies cannot be overemphasized. Periodic seminars at national level in India will help to solve regional problems and bring greater understanding among the seed scientists of the country.

This seed program, even though primarily referring to the situations in Madras State, may find application with suitable modifications in any state in India.

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APPENDIX

APPENDIX A

TABLE XVI

STATEMENT OF IMPROVED CROP VARIETIES RELEASED BY AGRICULTURAL RESEARCH STATIONS IN MADRAS STATE*

Name of the crop	Number of varieties						Total
	Coimbatore	Adudorai	Ambasamudram	Tirurkuppam	Palur	Tindivanam	
Rice	28	25	10	6	2	Nil	71
Sorghum	21	-	-	-	-	-	21
Cumbu	7	-	-	-	-	-	7
Ragi	9	-	-	-	-	-	9
Tenai	3	-	-	-	-	-	3
Groundnut	-	-	-	-	-	4	4
Pulses	3	-	-	-	-	-	3
Gingelly	-	-	-	-	-	3	3
Cottom	9	-	-	-	-	-	9
Total	80	25	10	6	2	7	130

*Particulars collected from A Note Book of Agricultural Facts and Figures, 1961, Government of Madras. Madras: Superintendent of Government Press, 1961, pp. 139-209.

TABLE XVII

STATEMENT OF PROPOSED ACREAGE UNDER CERTIFIED SEED AND EXPECTED CERTIFIED SEED FEE IN MADRAS STATE

Crop	Total acreage	Acreage under certified seed	Seed rate Lbs.	Approximate value of seed per acre (Rs.)	Proposed certification fee (Rs.)	Total estimated amount (Rs.)
FOOD CROPS						
Rice	5,778,927	3,000,000	40	8.00	0.20	600,000
Wheat	12,000	6,000	40	10.00	0.20	1,200
Sorghum	1,688,206	1,000,000	20	4.00	0.20	200,000
Cumbu	1,135,620	750,000	5	0.75	0.10	75,000
Ragi	1,748,000	1,000,000	5	1.00	0.10	100,000
Tenai	84,193	50,000	5	0.75	0.10	5,000
	10,446,946	5,806,000				981,200
PULSES						
Redgram	53,940	25,000	5	1.00	0.10	2,500
Horsegram	560,945	250,000	25	5.00	0.10	25,000
Greengram	129,642	50,000	15	5.00	0.10	5,000
Blackgram	149,742	50,000	15	5.00	0.10	5,000
	894,269	375,000				37,500
OILSEEDS						
Groundnut	1,830,616	1,000,000	100	20.00	0.20	200,000
Gingelly	342,258	200,000	5	2.00	0.20	20,000
	2,172,874	1,200,000				220,000
FIBER, Cotton	754,317	500,000	15	2.00	0.10	50,000
CONDIMENTS						
Chillies	121,800	50,000	3	4.00	0.10	5,000
Coriander	109,496	50,000	10	3.00	0.10	5,000
	231,296	100,000				10,000

APPENDIX C

TABLE XVIII

ESTIMATE OF ANNUAL EXPENDITURE OF PROPOSED MADRAS STATE SEED CERTIFICATION BOARD (HEAD OFFICE: MADRAS)

Charge item	Amount (Rs.)	Total (Rs.)
EXECUTIVE SECRETARY		
Pay and allowances		
at Rs. 600 x 12	7,200	
Allowance @ Rs. 150 x 12	1,800	
	9,000	9,000
OFFICE		
Technical Assistant		
Rs. 250 x 12	3,000	
Allowance 100 x 12	1,200	
	4,200	4,200
Clerks 1+4		
Rs. 140 x 12	1,680	
Allo. 60 x 12	720	
100 x 12 x 4	4,800	
Allo. 50 x 12 x 4	2,400	
	9,600	9,600
Last graders 2		
2 x 75 x 12	1,800	
2 x 25 x 12 (Allowance)	600	
	2,400	2,400
OFFICE RENT 200 x 12	2,400	2,400
Stationery 50 x 12	600	600
Postage 50 x 12	600	600
Traveling allowance & miscellaneous 200 x 12	2,400	2,400
Traveling allowance for board members at Rs. 50 per member per annum 50 x 22	1,100	1,100
Advertisement & Publicity	900	900
Total		33,200

TABLE XIX

ESTIMATE OF ANNUAL EXPENDITURE OF A PROPOSED DISTRICT SEED CERTIFICATION COMMITTEE OF THE MADRAS STATE SEED CERTIFICATION BOARD

Charge item	Amount (Rs.)	Total (Rs.)
SECRETARY		
Pay and allowances at Rs. 375 x 12	4,500	
Allowance 100 x 12	1,200	
	5,700	5,700
OFFICE		
Clerks 2+1 Rs. 140 x 2 x 12	3,360	
110 x 12	1,320	
Allowances 60 x 3 x 12	2,160	
	6,840	6,840
OFFICE RENT 100 x 12	1,200	1,200
Stationery 25 x 12	300	300
Postage 20 x 12	240	240
Traveling Allowances 100 x 12 (Staff)	1,200	1,200
Miscellaneous	60	60
Publicity	460	460
Traveling allowance for members @ Rs. 25/-per member per annum for 15 members 25 x 15	375	375
Total		16,375

TABLE XX

ESTIMATE OF ANNUAL EXPENDITURE OF A PROPOSED TALUK SEED CERTIFICATION COUNCIL OF THE MADRAS STATE SEED CERTIFICATION BOARD

Charge item	Amount (Rs.)	Total (Rs.)
SEED CERTIFICATION INSPECTOR		
Pay and allowances		
Rs. 250 x 12	3,000	
Allowance 75 x 12	900	
	3,900	3,900
OFFICE		
Clerks 1+1		
110 x 12	1,320	
100 x 12	1,200	
Allowance 2 x 30 x 12	720	
	3,240	3,240
OFFICE RENT Rs. 50 x 12	600	600
Stationery 10 x 12	120	120
Postage 10 x 12	120	120
Traveling allowance Rs. 30 x 12	360	360
Total		8,340

APPENDIX D

TABLE XXI

ESTIMATE OF THE ANNUAL EXPENDITURE OF THE PROPOSED MAIN OFFICE OF THE MADRAS STATE SEED CORPORATION

Charge item	Amount (Rs.)	Total (Rs.)
GENERAL MANAGER		
Pay and allowances		
Rs. 600 x 12	7,200	
Allowance Rs. 150 x 12	1,800	
	9,000	9,000
ASST. AGRICULTURAL ENGINEER		
Rs. 375 x 12	4,500	
125 x 12	1,500	
	6,000	6,000
TECHNICAL ASSISTANT		
Rs. 250 x 12	3,000	
100 x 12	1,200	
	4,200	4,200
OFFICE		
Clerks 4		
4 x 140 x 12	6,720	
Allowance 4 x 60 x 12	2,880	
	9,600	9,600
Last grader 100 x 12	1,200	1,200
Stationery 50 x 12	600	600
Postage 50 x 12	600	600
Traveling 150 x 12	1,800	1,800
Members T.A. @ Rs. 50 per member 50 x 15	750	750
Publicity	1,250	1,250
Total		35,000