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PRELIMINARY REPORT

M.S.U. Consultation Visit  
on  
Soybean Seed Drying - Processing - Storage  
Facilities  
in  
Ivory Coast

G. M. Dougherty, Mississippi State University  
G. B. Welch, Mississippi State University

4 - 7 January, 1975

1. Observations and Recommendations:

1. 1974 Harvested Soybeans: (Seed Stocks)

- a. It was determined there are approximately 60 tons seed (assorted varieties) 1974 harvested in storage. Estimated quantities and locations as given were:
  1. Yomoussokro (14 tons)
  2. Bouake (30 tons)
  3. Odiene (16 tons)
- b. Approximately 50 to 60 tons (estimated) were observed during trip to Central and Northern regions, as follows:
  1. 14 tons--Yamoussokro (conditioned)
  2. 28 tons--Yamoussokro (drying)
  3. 15 tons--Korhogo (open storage)
- c. Most seed observed (all uncleaned), from appearance look fair to good quality. However, based on results of tests conducted to determine value as planting stock (germination pct.). All seed observed was of very low quality. Based on findings, germination of seed, in storage ranges from 0 to 60%; majority in 20% to 30% range.
- d. Quality (germination) tests conducted, admittedly, were not conducted under favorable conditions, consequently, results obtained should be interpreted as preliminary estimates of true seed quality.
- e. It is recommended that all seed in storage be sampled and tested immediately to determine current true value.
- f. Material in 50-60% range (as determined by standard germination test i.e. representative sample, 4 x 100 seed) should be cleaned (air-screen cleaner) resampled and retested and placed in temperature controlled storage rooms i.e. Yamoussokro. Note: estimated capacity of 3 rooms at Yamoussokro = 100-130 tons.

Screens for cleaning soybeans are not available for air-screen cleaners observed. Consequently, all cleaning will be done with the aspiration system on the cleaners. Though not as effective as desired; this procedure will yield satisfactory results. Air should be set to remove 20% of the mass being cleaned (by weight).

- g. It is recommended that if a large acreage is planned for planting in 1975 that orders be placed immediately for 80% to 90% of 1975 planting stock requirements. These orders can be revised at later date, as judged necessary,

from results of tests obtained. (see d, e, f)

- h. Upon receipt, "new" seed should be sampled for germination and immediately placed in conditioned storage.
- i. Seed quality (germination) tests employed should be the Standard Germination Test. Start with representative sample, plant 4 replications of 100 seed each using "rolled towel" or "sand bench". In opinion of consultants, the sand bench method would be most practical. In the opinion of consultants these tests should be conducted under supervision of:
  - 1. Dr. Ayemou Assa (Abidjon) or
  - 2. Diallo Roger (Korhogo) or
  - 3. INRAT (Bouake)

Consultants preference, based on opportunity to discuss testing procedures and observations of testing facilities readily available, would be Diallo Roger. If, due to Regional boundries, all tests can not be supervised by a single individual; close coordination among supervisors involved is essential if test results are to be meaningful.

- j. All seed to be saved for 1975 planting should be sampled and tested, each month, from now to planting time. Results (tests) should be recorded and forwarded to:
  - 1. Dr. Ayemou Assa or
  - 2. Diallo Roger

for analysis purposes. These results (test) accompanied with records of temperature and humidity conditions in storage rooms will be useful in determining requirements (in terms of equipment) required for soybean storage in future installations.

- k. It is recommended (strongly) that equipment previously ordered (see Bunch Report, June, 1974) and now in country, be distributed to locations where seed is being stored, i.e. Hygrothermographs, dehumidifiers should be installed in rooms of Yamoussokro as soon as possible. Conditions under which seed are stored between March - April to planting time (July) will have pronounced effect on their germinative potential when sown. Consequently, recommendations made (e thruj) should be carried out prior to March, or work may be wasted effort.

## 2. Drying - Processing - Storage (Seed) Facilities:

- a. Adequate drying facilities for Soya were not observed; they are believed to be non-existent, with exception of small (pan-type)

dryer observed at INRAT (Bouake).

The INRAT dryer, can and should, be utilized (copied if necessary) for drying of small quantities (5 kgs - 41 kgs 1 tray) experimental material.

Recommended Drying Procedure follows:

1. Adjust heat to limit temperature (max. of drying air to 29°C. (85°F). If required, a drying air temp. of 32°C (90°F) can be used, but in so doing care must be exercised to prevent over-drying of material in bottom of pans. This can be accomplished by taking seed moisture readings every 4 hrs. after seed has reached moisture content of 14%. Seed should be dried to 10-12% moisture content.
- b. Rice dryers at Yamoussokro, Bouake and Korhogo (not yet installed at Korhogo) are unsuitable for drying soybean seed. These type dryers would:
  1. dry seed too rapidly
  2. present contamination problems (varietal mixtures)
  3. hard on Soya seed from mechanical damage viewpoint.

Much of the loss in quality (germination) experienced with the 1974 harvested seed crop is believed due to improper drying. Owing to non-existence of good soybean seed drying facilities seed were dried any way possible (drying floors) to reduce moisture content to 12%. Methods utilized were effective; but drying periods were prolonged, resulting in rapid seed deterioration during the drying period.

- c. Adequate seed drying facilities are required. These facilities should be operational by October, 1975 to handle the 1975 harvested seed. Recommendations as to type, size, numbers needed and specifications will appear in the final report.
- d. Facilities to handle (process) of 1975 Soybean seed crop are non-existent. Though up-grading of 1974 crop seed has been recommended using cleaner at Kerke Seed Farm (See 1f) this is not a practical solution for processing the 1975 production.
- e. Adequate seed processing facilities are required. These should be operational by October, 1975. Recommendations and specifications of needed equipment will be submitted as part of final report.
- f. Favorable storage facilities (for Soybean) are limited in number. At present, only conditioned storage areas available for use are 3 rooms, each with storage capacity of 34 ton seed (each 40% fill). On site tests conducted during visit, by consultants, showed rooms conditions of : 26°C (temp); 68% relative humidity. Observed conditions i.e. temp and relative humidity, though generally satisfactory must be considered minimal requirements

for preserving seed quality (maintaining satisfactory germination).

Improvements to these rooms are recommended to improve their environments and lessen operational costs of the air-conditioners. Recommendations are as follows:

1. Installation of gaskets around door to prevent unnecessary air leakage.
  2. Seal-up openings where wood panels meet concrete block wall to prevent air leakage.
  3. Plaster (mortar) inside concrete block walls and make smooth (easier pest control).
  4. Re-paint outside walls with moisture penetration retardant type paint.
  5. Install vapor barrier (6 mil polyethylene film) atop plywood (existing) ceiling.
  6. Install 2" thickness rigid insulation (or equivalent under ceiling and all interior walls.
  7. Install recording hygrothermograph and dehumidifier (available) in rooms.
  8. Install ducting on air conditioner outlet so as to expel cool air (entering the room) in a horizontal plane approx. 15 cm from the ceiling.
- g. SIVAK establishment (km 22 Ferke) could, relatively easily, be converted into very satisfactory conditioned storage room for soybean seed. Modifications and equipment required follows:
1. Remove existing windows and enclose openings with concrete blocks. Note: leave openings for two (2) air conditioners.
  2. Install gaskets around door.
  3. Install two (2) 15,000 BTU thru-the-wall type air conditioners (local supplier). Conditioners should be installed to expel cool air (horizontally) approx. 50 cm below ceiling. Conditioners should be shaded (outside) against direct sunlight.
  4. Provide electrical outlets, one on each interior wall for use with dehumidifier.
  5. Install 4" rigid insulation (or equivalent) on ceiling and walls.
  6. Paint outside wall surfaces with moisture penetration retardant paint.

7. Install hygromograph and dehumidifier (both are available).
- h. Abandoned buildings at Badikaha were observed to determine their usefulness as seed storage facilities. In opinion of consultants these buildings would require major renovation. Consultants question advisability of undertaking renovation of buildings since best location for future seed facility, i.e., best production region is probably too far distant for convenient storage.

Consultants believe the storage facilities at Yamoussokro and SIVAK, with combined capacity of 274 ton seed would be sufficient until completion of well designed (new) seed facility (recommended elsewhere in report).

### 3. Personnel:

- a. Consultants were favorably impressed by interest shown by most persons contacted in finding solutions to problems faced in soybean production, processing, drying and storage.
- b. Consultants noted a serious lack of knowledge relative to the characteristics of soybean seed, i.e. susceptibility to damage due to deterioration and mechanical injury; maturation cycle; growth and death of seed in general. This points up necessity of specialized training if the soybean project is to have any chance of succeeding.
- c. Consultants believe, with specialized training and provided adequate facilities, personnel can do creditable job. This is, however, not to imply that soybeans can be produced economically. This point is yet to be determined.

### 4. Soybean Seed Testing Facilities:

- a. Consultants viewed only one installation with seed testing facilities. This was the SODERIZ Laboratory at INRAT in Bouake. This laboratory had no facilities for testing germination of soybean.
- b. It is recommended that the seed facility to be designed include seed testing facilities for maize, soybean and rice.

### 5. Grain Storage:

- a. In discussions, attention focused on requirements for handling planting stock seed. Minimal time was spent discussing grain handling installations. As the seed supply increased so does general production for grain. Growth of grain production being far greater than seed production.
- b. View of consultants is that, among individuals contacted, few have given in depth study of the magnitude in the potential growth of grain storage capacities required.

- c. Mississippi State University will submit layout designs and equipment specifications for a grain storage unit with a capacity of approx. 1,000 T capacity. This unit will have same design features shown for the seed unit. (target date 10 March).

#### SUMMARY

Mississippi State University Seed Specialists G. B. Welch and G. M. Dougherty arrived in Ivory Coast on 5 January, 1975. Purpose of visit was to observe existing Soybean seed facilities and determine immediate future needs for handling production during the 1975 crop year. Visit was at the invitation of the Minister of Agriculture. Objectives of visit was to advise Minister of Agriculture of findings and submit recommendations for future action.

Itinerary prepared by SODERIZ provided consultants opportunity to travel to current soybean production, area, to view existing facilities and to discuss drying, processing and storage problems with field technicians and administrative personnel. Consultants, with excellent cooperation from all contacts established, were successful in the period of two weeks to gain an excellent understanding of the situation relative to needs in Ivory Coast for Soybean handling facilities.

Consultants established the two most serious problems to the Soybean Project were: (1) inadequate handling facilities and, (2) Serious shortage of personnel trained in the handling of soybean seed in particular and seeds in general, other than rice.

Soybeans and other "high" oil content seed are generally characterized as "naturally short-lived" seed. Soybeans, especially at high moisture contents, are very susceptible to mechanical injury and sensitive to the natural processes of deterioration common to all in the biological system. Soybeans, owing to their extreme sensitivity to photoperiod, in the Ivory Coast, at present, must be harvested and handled in somewhat adverse conditions. Therein lies the problem of maintaining good, "acceptable" seed quality.

Consultants determined quality of soybeans seed harvested in 1974 to be of very low quality for planting purposes in 1975. Much, or all, of the 1975 planting stock will have to be imported from abroad or nearby countries.

Consultants recommend that Mississippi State University provide Ivory Coast with layout plans and equipment specifications for a seed facility with a drying capacity to handle a maximum intake of 20 ton seed per day. Processing facility should be of a capacity of 3-4 ton/hour. Conditioned storage should be provided. The seed facility should be operational by November 1975 for the 1975 Soybean crop. The facility will have capabilities to handle soybeans, maize and rice. Target date for delivery of plans is 10 March, 1975.

Consultants have made other recommendations relative to modification of existing facilities for safe storage of soybean seed as insurance against non-completion of the seed facility as scheduled.

Consultants at special request of Minister of Agriculture agreed to supply layout plans and equipment specifications for a 1,000 ton "module" grain storage facility. Target date for delivery at these plans is 10 March, 1975.

Consultants consider need of specialized training in seed technology of paramount importance to success of the Soybean Project. Consequently, recommendations are made for "short term" training at MSU in 1975 for 2 or 3 participants to be selected by the Ministry of Agriculture. Similar training for an additional 2 to 3 participants in 1976. Additionally, consultants recommend the Ministry of Agriculture consider one candidate for M.S. degree training in Seed Technology. This program should start in 1976.

Consultants had opportunity to check-out, and instruct Ivorians in use of, equipment recently purchased by the Ministry of Agriculture and SODERIZ from the U.S. for use in the Soybean Seed Project.

Consultants express their sincere appreciation to all contacts established in the Ministry of Agriculture and SODERIZ and the U.S. Embassy, for their cooperation and assistance during the period of the assignment. Special recognition is due Mr. G. Donahue, U.S. Embassy, Abidjon. To him we say sincerely "Thanks very much".

Respectfully submitted,

George Dougherty  
G. Burns Welch