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Quality Control in Hybrid Sorghum Seed Production

J. Aillson

QUALITY CONTROL IN HYBRID SORGHUM SEED PRODUCTION

James Allison[1]

The major objectives of any hybrid seed production program are to produce seeds which have a high germination percentage, excellent seedling vigor and are mechanically and genetically pure.

The concern of this section of the conference is how to attain excellent genetic purity in the production of hybrid sorghum seed. Seed labeled hybrid must be 95% hybrid. The goal is to reach the ultimate and have 100% true hybrids. There are difficulties of achieving this goal for the various types of sorghum hybrids-sudangrass, forage and grain sorghum hybrids. The primary emphasis will be on the production of grain sorghum hybrids with 100% pure parental lines and proper isolation. This seems to be a relatively easy task, but there are many factors which contribute to the success or failure of hybrid sorghum seed production.

Isolation and controlling external factors are often the results of many years of planning and working with the same farmers in a give area. Many of the isolation problems can be averted by prior planning between farmers and through cooperation between the various seed companies.

The various types of hybrids are grown in different areas of production - each isolated from the other and from commercial production. Since pollen from undesirable plants, especially sudangrass and shatter cane, can travel five to ten miles under favorable conditions. the cooperation between seed companies in Texas, in planning production, has led to fewer problems with isolation.

One of the big factors in the production of hybrid sorghum seed is the use of genetically pure parental lines. Both the seed row (female) and the pollinator (male) should be as free as possible of any off-type plants. After careful planning for good isolation, pure parental lines, and uncontaminated fields, hybrid seed production is ready to begin.

The primary goal of any hybrid production is to have an abundant supply of desirable pollen available at the same time the female plant is receptive. This will greatly reduce the possibility of external

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[1]Director of Research, Taylor-Evans Seed Company, Tulia, TX.

contamination or out-crosses. Added insurance is to have pollen available both prior to and after the female plant is receptive. Again, this seems very simple, but to achieve this over years and locations is difficult. Plant breeders can do much to increase pollen shed by selecting better R-lines such as Tx430 and Tx2737 which are excellent early-morning pollinators when compared to R-lines such as TAM428 and Tx435 which are considered to be poor, late-morning pollen shedders. The commercial plant breeders are more aware of this problem than are the public plant breeders.

The proper timing or nicking is greatly influenced by many factors. Different planting dates and locations, especially latitude differences, can have a great effect on timing, particularly if one parental line is more day-length sensitive than the other line. Other factors which greatly influence timing are growing degree days, soil temperature and soil moisture. In many cases one of the parental lines will be more affected by one or more of these factors than the other. Most hegari derivatives are greatly influenced by all of these factors and their flowering times are most difficult to predict.

In many instances, the highest yielding hybrids are obtained from parental lines with the greatest timing spread or the widest split between the seed row and the pollinator. The wider the split, the greater the possibility for lower genetic purity or greater number of undesirable out-crosses. There are several things that can be done to the pollinator rows to insure maximum pollen shed at the desired time.

A. Split-planting - this is planting the pollinator at three (3) different times at 5-7 day intervals and planting early enough to have pollen three (3) days prior to the female being receptive.

B. Plant the pollinator rows at different depths and rates at each planting.

C. Mutilate one row each of the first and second plantings.

D. Plant pollinator on all ends of the field (called stubbing).

The next step to enhance genetic purity is the removal of undesirable plants, referred to as roguing. This is accomplished by three roguings for sudan and forage hybrids and up to five times for grain hybrids. The cost of this operation is between $50.00 to $120.00 per acre. Roguing begins just prior to bloom (full boot stage) and continues throughout the bloom stage. It is necessary to rogue both the seed and pollinator rows. The schedule is as follows:

A. First to remove mutations, volunteer, and any impurities in parental lines.

B. Second, third, and fourth (if necessary) to remove B-lines (shedders) as they occur in the seed row.

C. Fifth - just prior to harvest for cosmetic effect and remove any off-type heads in the seed rows.

Starting with the highest quality parental lines and planting on uncontaminated fields will greatly reduce the roguing cost.

When proper isolation cannot be attained, it may be necessary to rogue adjacent commercial fields for mutations, sudan, and forage hybrids. This usually can be accomplished by one roguing just prior to the female becoming receptive. Also ditches, road-ways, railroads, irrigation pits and abandoned farmsteads, are sources of contaminants such as volunteer sudangrass and johnsongrass. The minimum distance from sudan is two (2) miles and johnsongrass 1/2 mile. These undesirable plants can be controlled by spraying with Roundup, MSMA or DSMA.

Cool temperature during the time the female is receptive will cause foreign pollen to travel greater distances and will result in a greater number of undesirable plants. Hot dry weather during pollination, will cause a lower seed set, but will often result in fewer off-type plants.

Prior to harvest, hand samples are taken for grow-outs and planted in some tropical or semi-tropical location such as Florida, Hawaii, Mexico or Puerto Rice. These samples are taken by criss-crossing the field and taking branches from random selected heads. The objective is to obtain the most representative sample possible for the grow-outs.

At harvest, the pollinator rows are harvested first and sold for feed grain. Prior to harvesting the seed rows, all combines, grain carts, augurs, and trucks are thoroughly cleaned to prevent mechanical contamination. After each pedigree is harvested, the procedure is repeated to insure genetic purity.

As the grain is taken to the conditioning facilities, each truck load is probed several times to obtain a representative sample. A composite sample (30 to 50 pounds) is collected from each field and these samples are sub-divided into various quantities as the company deems necessary for the proper grow-outs. These grow-outs are planted from 1/10 acre to 1/2 acre in size and have a population from 6,000 to 60,000 plants.

Many commercial companies conduct their own winter grow-outs or use the service offered by the Texas department of agriculture in

conjunction with the Texas Seed Trade Association. This service is offered on a fee basis and the cost depends on the size sample and the location of the grow-out. It is very important to get the grow-outs planted as soon as possible after they are collected. The dates offered by the Texas Department of Agriculture are as follows:

A.	September 15-20	Mexico
B.	October 15-20	Mexico
C.	November 15-20	Mexico
D.	December 10-15	Puerto Rico

These dates may vary slightly from year to year depending on weather conditions at harvest. Approximately 220 acres are planted in Mexico and 80 acres in Puerto Rico each year. Due to the possibility of a frost in Mexico, most companies have a back-up location in Puerto Rico or Hawaii. Samples can be read in Puerto Rico in 50-55 days where it may take 75 to 90 days at the Mexico location, because of the cooler night temperatures.

Grow-outs for certified seed must be sampled by an official of Texas Department of Agriculture (T.D.A.) and included in one or more of the grow-outs. These are official samples and are read by T.D.A. personnel. With the increased demand for certified seed on the export market this service is becoming more and more important. The standards used by the Texas Department of Agriculture for certification are as follows:

Varietal Purity Grow-out Test Standard

Maximum Objectionable Sorghum Plants Permitted in:

A. Grain Type Hybrid

Grass Types	
Rhizomatous outcross plants, broomcorn origin plants, and/or vigorous and/or tillering plants	0.05% (1:2,000)
non-rhizomatous, single stemmed (non-tillering) plants of the same genetic height as the hybrid including mutation heights	0.10% (1:2,000)
Hegari Types	0.08% (1:1,250)
Other Forage Types	0.10% (1:1,000)
Combination of above three	0.10% (1:1,000)

Off-type heads of same genetic height plants

Off-type and/or slightly off colored heads	5.00% (50:1,000)
Opposite colored heads	2.00% (20:1,000)
Combination of above two	5.00% (50:1,000)

B. Forage Type Hybrid

Grass Types	0.5% (1:1,000)
Combine Types (including "selfs")	5.0% (50:1,000)
Combination of above two	5.0% (50:1,000)

C. Grass Type Sorghum-Sudangrass Hybrids

Forage Types	0.5% (5:1,000)
Combine Types (Including "Selfs")	5.0% (50:1,000)
Combination of above two	5.0% (50:1,000)

D. Grass Type Sorgo-Sudangrass Hybrids

Forage Types (Including "Selfs")	5.0% (50:1,000)
Combine Types (Including "Selfs")	5.0% (50:1,000)
Combination of above two	5.0% (50:1,000)

E. Grass Type Sudangrass-Sudangrass Hybrids

Forage Types	0.5% (5:1,000)
Combine Types (Including "Selfs")	5.0% (50:1,000)
Combination of above two	5.0% (50:1,000)

F. Male Sterile Seed Stock

Off-Type Plants Other than the Male Sterile

Counterpart Shedders and Mutations	0.66% (1:1,500)
Plants shedding pollen but otherwise indistinguishable from the male-sterile counterpart	0.10% (1:1,000)

G. Pollinator Lines (B & R)

Off-Type Plants, other than mutations, allowable in the pollinator lines is limited to 0.066% (1:1,500)

The quality control standards for non-certified seed are determined by each individual seed company and in many cases are more strict than those enforced by the certification agency. If the standards which are set by the commercial companies are not met and the seed is rejected it is sold for feed grain. This is very critical to all seed companies, because they have contracts with individual farmers for the production of seed and if the seed is rejected the farmer will not receive his premium for the seed. The price paid to the farmers for seed is 2 to 4 times that of commercial sorghum.

The grow-outs for each grain hybrid are based on the following ratings:

A. Mutations or True Talls
B. B-Lines (selfs) or other grains
C. Forages
D. Grasses
    1. Rhizomatous
    2. Non-Rhizomatous
E. Plant Population

As the crop is harvested each variety is placed in storage or a holding bin until the purity has been determined. At this time, each lot of seed is conditioned and are used to determine germination percentage, mechanical purity, and one last grow-out. This is to determine if the earlier grow-outs are correct and to check and see if any mechanical contamination has taken place in storing or conditioning the seed.

Always keep in mind that seed quality will always vary from year to year. Standards can be set by seed production people, but "mother nature" has a way of playing havoc with many of their goals.

The final objective of commercial seed companies is to have a satisfied and happy customer in order to get repeat business. Any short cuts in the process will jeopardize this objective.

STEPS NECESSARY FOR THE CERTIFICATION OF PLANTING SEED IN TEXAS	RESPONSIBILITIES OF SEEDSMEN AND CERTIFYING AGENCY TO CERTIFY HYBRID SORGHUM SEED IN TEXAS
1. Grower plants genetically pure parent seed of known source.	1. Date chosen by seedsman
2. Grower voluntarily applies to TDA Seed Program for certification of seed.	2. 30 days after planting
3. Seed Program verifies eligibility of land and seed source planted therin.	3. Immediately after application is received by certification agency
4. Seed Program sends information for making field inspection to inspector.	4. Before seed fields are ready for inspection.
5. TDA Inspector inspects seed crop being grown in field.	5. Two inspections before bloom, one inspection after seed begins to color
6. Grower harvests seed crop.	6. When mature
7. Inspector inspects equipment used to condition seed.	7. Before seed conditioned
8. Grower conditions seed.	8. At seedsman's choice
9. Inspector or grower collects sample of seed and sends to TDA Seed Lab.	9. When necessary for graw outs
10. Seed Lab analyzes seed sample and plants for grow-out test	10. In time for graw out selected by seedsman
11. Grower requests Texas Seed Certification labels from Seed Program.	11. When seed are eligible for certification and when seedsmen request tags.
12. Seed Program verifies eligibility of seed for certification labels.	12. After graw out
13. Seed Program issues certification labels to grower.	13. When certification is completed and at request of seedsman.
14. Growers attach certification labels to containers of the seed in a manner which prevents their removal without mutilation	14. When seedsman packages seed
15. Grower makes seed available for sale to farmers.	15. At seedsman's choice.