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Subject:	Old Texas A&M Document on Sorghum Off-Types
Date:	Wednesday, November 04, 2009 6:12:31 AM
Attachments:	Off-Type Sorghum Plants A&M MP-885 Aug1968.pdf

Dear Colleagues: Attached is a PDF copy of a 1968 Texas A&M document entitled "Off-Types in Grain Sorghum" (publication MP-885, August 1968) by Ed Clark and Darrell Rosenow. This document came to me out of the files of one of our seed companies, who commented that they had received some questions about sorghum off types this year, and they asked if there was anything more updated or might have more recent, higher resolution color photographs.

Do any of you know of anything more recent? I will read through this on my next rainy day, but I wanted to call this to your attention. As far as A&M is concerned this document was essentially lost, so I appreciate the opportunit to bring it to light again.

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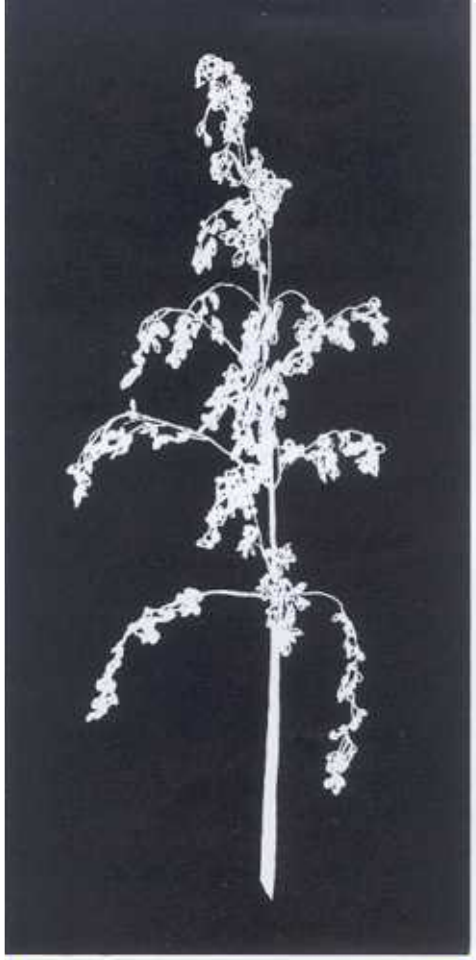

OFF-TYPE SORGHUM PLANTS

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1-A

1-B

Figure 1. **Tall mutants.** Figure 1A. A field with tall-mutant plants; Figure 1B. A closeup of two normal plants and one tall-mutant plant. Tall-mutant plants occur in all grain sorghum hybrids, and they are identical to the hybrid in which they are found except that they are 1 to 2 feet taller. They occur as a result of spontaneous genetic change (mutation) in one or both parents of the hybrid and do not result from contaminating pollen. They usually occur in relatively small numbers and are of little consequence with respect to production and harvesting, although they give fields a nonuniform appearance. There is no greater volunteer problem with seed from these tall mutants than with normal grain sorghum, and there is little advantage to roguing them out of a field other than to obtain a uniform appearance.

2

Figure 2. **Off-type or off-color heads.** Figure 2. A field of red grain sorghum with numerous white heads. These off-type grain sorghum plants are similar in height to the grain hybrid in which they are found but may be extremely variable for head type and grain color. The grain color may be white, yellow, red, brown or intermediate shades. These plants may develop from seed that are planted, or some may be volunteer plants. Off-type plants developing from seed that are planted are outcrosses originating from foreign pollen contaminating the seed production field. The foreign pollen may be from fertile plants (shedders) in the male-sterile seed row, or from other grain sorghum fields located near the seed production field (usually a mile or closer). Usually there is little, if any, greater volunteer problem with off-type grain sorghum than with normal grain sorghum, and there is little advantage to roguing out these off-types.

3-A

3-B

Figure 3. **Forage types.** Figure 3A. A field with some forage-type plants; Figure 3B. A close-up of a forage-type plant. These are tall, vigorous plants with coarse stems and fairly compact grain-type heads, and their maturity may be similar to the grain sorghum or much later. These plants may develop from seed planted with the crop, or they may be volunteer plants. Off-type plants developing from planted seed are outcrosses, resulting from pollen of forage-type plants contaminating the seed production field.

The forage-type plants referred to here include such types as forage hybrids made with grain sorghum and hegari, or sorgo types such as Atlas, Sumac, Orange, or the varieties themselves, which have fairly compact heads and whose seed thresh free of the glumes. Plants in this group are more objectionable than the previous ones, because they frequently cause loss of grain in the combining operation. These tall plants may be pushed under the combine and carry considerable grain sorghum with them.

Seed from these plants usually are not any more dormant than grain sorghum, but since their seed frequently are not harvested, they provide a potential source of additional volunteer plants in succeeding crops. These off-type plants should be rogued out of a field before seed are formed, or the plants should be completely removed from the field after seed are formed, instead of leaving them in the field as in the usual roguing process.

4-A

4-B

Figure 4. **Rhizomatous grassy types.** Figure 4A. A comparison of johnsongrass (left) and a grain sorghum X johnsongrass hybrid (right); Figure 4B. Variation in head type—hybrids of grain sorghum with: johnsongrass (two heads on left), sorghum almum (middle), sudangrass (two heads on right); Figure 4C. Root system of a grain sorghum X sorghum almum hybrid showing rhizomes; Figure 4D. Root system of a grain sorghum X sudangrass hybrid with no rhizomes. These rhizomatous grassy hybrid plants usually are taller than the grain sorghum, and have slender stalks with many tillers. The heads are very loose and open, like johnsongrass or sorghum almum, and produce few or no seed because the plants are genetically unbalanced and highly sterile. Compared to johnsongrass, these plants usually have short, weak rhizomes (underground stems).

Plants in this group may develop from seed planted with the crop, or they may be volunteer plants from seed or rhizomes. If they are from seed planted with the crop, they result from johnsongrass or sorghum almum pollen contaminating the seed production field. If they are volunteer plants, they may result from the few seed that can be produced by the off-type hybrids, or they may volunteer from rhizomes which overwinter.

Although plants in this group seldom produce seed, the seed that are produced are protected by long glumes, and most of the seed are dormant for long periods, partly because of the persistent glumes. Some of the rhizomes may overwinter, especially in areas with mild winters, and produce plants the following year. Deep plowing, preferably in the fall, digging up the rhizomes or chemical control may be necessary.

Regardless of the source of these plants, they should be rogued out of any field in which they are found. They should be destroyed as soon as they are recognizable to avoid establishment of rhizomes. Roguing can be accomplished by digging the plants out or by spot spraying with chemicals. The rhizomes and any seed that may be formed should be completely destroyed or removed from the field.

4-C

4-D

Figure 5. **Non-rhizomatous grassy types.** Figure 5A. A field with numerous non-rhizomatous grassy-type plants; Figure 5B. A single plant of a grain sorghum X sudangrass hybrid with three tillers; Figure 5C. Variation in head type of grain sorghum X sudangrass hybrids; Figure 5D. A field with numerous grassy-type plants with the seed shattered from the heads. These plants commonly referred to as shattercane are normally taller than grain sorghum. Many tillers usually are produced, and each tiller produces a head that is loose and open.

These plants are completely fertile and produce many seed which may volunteer in succeeding crops. They may be present in a grain sorghum field as volunteers or may result from seed planted with the crop. If they are from the latter source they result from pollen from sudangrass, sorghum-sudangrass hybrids, Honey sorgo or Amber sorgo types contaminating the seed production fields. The plants in this group are extremely variable with respect to height and other plant characteristics. However, the type that tends to persist after one or more years of volunteering is tall with slender stalks, loose heads, and seed covered with long dark brown or black glumes.

Plants in group 5 probably are the most objectionable of all the off-types. This is because they produce so many seed which are protected by long glumes and which may remain dormant in the soil for several years. The volunteer problem with this type is very severe. The source of these volunteers originally may be from seed planted with grain sorghum. However, many of the volunteers may originate in acreage previously planted to sorghum-sudangrass hybrids, either for grazing or diverted acreage. Other sources of seed of this type causing volunteer problems include cattle and bird droppings, flood water and irrigation water. Seed of these plants also may be carried into a field by machinery, particularly harvesting equipment. Still another source of off-types is mixing planting seed, particularly carryover seed from the previous year which may have the labels removed.

Plants in groups 3 through 5 may produce seed which shatter easily; however, the shattering problem is most severe in groups 4 and 5. These seed usually shatter before harvest and plants in group 5 provide a tremendous number of seed, many of which may produce volunteer plants. This is illustrated in Figures 5D and 6. Plants in group 5 should be rogued out of fields before they produce seed. Seed are potentially germinable as soon as 10 days after flowering. Therefore, off-type plants must be removed at flowering time, or at least, no later than a week after flowering. They should be cut at or below ground level to avoid regrowth. If some plants are missed and seed are formed, these plants must be carefully removed from the field to avoid a volunteer problem.

5-A

5-B

5-C

5-D

Figure 6. Seed deposited on ground from shattering type plants shown in Figure 5D.

Figure 7. Large circular patch of volunteer grassy type sorghum plants.

Figure 8. Volunteer sorghum in a soybean field.

OFF-TYPE SORGHUM PLANTS

L. E. Clark and D. T. Rosenow*

Off-type sorghum plants compete with grain sorghum and other crops for water, nutrients and sunlight. These plants not only compete with the current crop, but some may produce seed that will contribute to a severe volunteer problem in succeeding years. The off-type plants that contribute most to a volunteer problem should be controlled the same as other weeds.

There are two main sources of off-type sorghum plants: (1) Volunteer plants from seed present in the soil from previous years. Plants from this source have been present as long as sorghum has been grown. (2) Seed present in the planting seed that will produce off-type plants. Plants from this source have increased since the advent of sorghum hybrids in 1957. The reason for this is that male-sterile plants (plants that produce no pollen) must be used in the production of hybrid seed. Male-sterile and male-fertile plants are grown in alternate rows in a crossing block. Pollen from the fertile plants is carried by wind to the male-sterile plants where pollination occurs and hybrid seed are formed. Pollen from undesirable plants can be carried in the air for long distances and can also pollinate male-sterile plants. The hybrid seed resulting from foreign pollen appear the same as the desirable hybrid seed and cannot be detected in laboratory tests for pure seed. Plants from these seed are called outcrosses.

The five major groups of off-type sorghum plants are illustrated in the following photographs. A description and the possible origin of plants in each group are presented with each photograph.

DISCUSSION

At present, it is not possible to completely avoid off-type plants in hybrid grain sorghum. Few, if any, sources of planting seed are completely free of off-types. Because these off-types in planting seed are hybrid seed, they are not distinguishable from desirable grain sorghum seed in laboratory tests. However, the Texas Department of Agriculture provides winter grow-out tests in which these off-types can be detected. Most producers of hybrid grain sorghum seed either avail themselves of this service or conduct their own grow-out tests. Every attempt should be made to buy seed with a minimum number of objectionable off-type plants, keeping in mind that all other quality factors of purity, germination and hybrid performance also must be considered.

It is important to determine whether off-type plants in a grain sorghum field are volunteers or from planted seed. To determine this, the following should be observed:

1. If the off-type plants are from planted seed, they will be individual plants uniformly distributed over the entire field. These plants will be in the seed furrow with the grain sorghum.

2. If the off-type plants are volunteers, they will be in circular patches of several to many plants and normally will be concentrated in certain areas of the field in which smaller patches were located in previous years. This is illustrated in Figure 7. Some of the volunteer plants will be to the side of the seed furrow, but many will be in the seed furrow due to normal cultivating practices.

To control volunteer plants from seed already in the soil, rotations should be used if possible. Rotating with broad-leaved crops such as cotton or soybeans combined with herbicides recommended for controlling grasses in these crops is a good practice to control volunteer sorghum. Seed already in the soil may produce volunteer plants for several years. Therefore, 1 or 2 years out of grain sorghum is not always sufficient to control volunteer sorghum. The number of years plants will volunteer from seed already in the soil is influenced by weather conditions from year to year and by different geographical locations. The volunteer problem is more severe in areas that have a short growing season. Cold weather early in the fall and/or low rainfall during the off-season will not permit plants to volunteer so they can be plowed up in the fall and before planting in the spring. These conditions will cause the volunteer problem to be more severe as is evident in Figure 8 which shows grain sorghum, as well as grassy type, volunteers in a soybean field after an extremely dry winter in the High Plains of Texas. On the other hand, longer growing seasons combined with mild winters with adequate rainfall will permit much of the volunteer to be plowed out during the fall and possibly again in the spring before planting. To encourage volunteering in the fall, it is a good practice to shred and disc immediately after harvest.

Buying good seed, continuous roguing in grain sorghum fields, and appropriate control measures in rotations are the only approaches to reducing the problem of off-type sorghums.

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