SESACO
SESAME COORDINATORS

SESAME GROWER GUIDE

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www.sesaco.net

QUICK FACTS

Reasons to Grow Sesame

- More profitable with limited resources than other crops using the same resources.
- Offers more return for less cost (less risk) than other crops.
- Sesame is very drought and insect resistant.
- Sesame suppresses the root-knot nematode and cotton root rot for the following crop.
- Sesame increases moisture retention and soil tilth, and the following crops have increased yields with reduced production costs.
- Sesame has negligible economic damage from deer, hogs, and birds.

Temperature Requirements

- Earliest time is when there is a 70ºF soil temperature in the morning.
- Latest time is 4th of July.

Soil Requirements

- Grows best on medium to light, well-drained soils.
- Prefers pH 5-8.
- Does not tolerate salinity or standing water.

Land Preparation

- Good land preparation is essential for a good stand since seed is small.
- Both row planters and drills work well.
- Can use conventional or no-till practices.
- Row spacing from 15" to 40".

Variety Selection

- Rio Grande Valley TX: S26.
- Uvalde TX area: S26 for dryland; S26/S28 for irrigated.
- Rolling Plains (San Angelo TX thru Altus OK): S26.
- Caprock TX: S25/S29.
- Oklahoma: S25/S29.
- Variety to be tested: S32.

Planting Sesame

- Place the seed 1/2 inch to 3/4 inch below the defined moisture line with a 1/4 inch to 3/4 dry covering of dry soil above that line. The total seeding depth would be from 3/4 inch to 1.5 inches.
- If a planting rain follows a drought, make sure that the top moisture has joined the bottom moisture. No root will push through dry dirt.
- Needs moisture around seed 3 days (late planting/warmer) to 5 days (early planting/cooler).
- Do not fill boxes above 6-8" because will grind seed.

Planting Rates

- Between 2.5 to 4.5 lbs/ac depending on row spacing and planting conditions. First time growers should strive for 3 to 3.5 lbs/ac.
- Good starting point: 25 to 35 seeds per foot.

Weed Management

- Only registered herbicides: clethodim (Select) and glyphosate (RT3).
- Working on Section 18 for metolachlor (Dual magnum), diuron (Direx), and linuron (Lorox).
- Can cultivate 3-4 weeks after planting and can throw soil up on stem.

Fertility Management

- The best sesame yields are on fields that are fertilized with balanced NPK fertilizers.
- Sesame is deep rooted and will scavenge for fertility below most crops roots zones, but that only works once. Need to fertilize the next year.
- If possible, apply half at start of flowering. Uses N primarily during flowering.

Amount of moisture	Units of N/ac
Dryland under 28" annual rainfall	25-35
Dryland over 27" annual rainfall	30-60
Full irrigation (10-12")	60-80
Semi-irrigation (6-8")	40-60
Semi-irrigation (2-4")	30-50

Water Management

- Uses less water than cotton, corn, sorghum, soybeans, or peanuts.
- Sesame is one of the most drought tolerant crops in the world but will give higher yields with more moisture.
- A heavy pre-irrigation is the best water the sesame will get.
- Prefers fast light irrigations. Too much water kills sesame. Sesame cannot survive standing water.

Disease and Insects

- Basically, no problems in the growing area with present varieties.

Harvest

- Sesame will dry down 120-150 days without a frost. It will dry down sooner with a frost or freeze.
- Most combines do an excellent job when set up properly. The operator is more important than the combine.
- Most combines use a platform header.
- Seed is 50% oil. Needs to be below 6% moisture (equivalent to 12% corn).

TABLE OF CONTENTS

INTRODUCTION

SESACO is the premier genetic developer, processor, and marketer of US grown sesame. SESACO has developed the only non-dehiscent (ND) sesame (US patent number 6,100,452) with traditional breeding techniques. SESACO's ND sesame changes the way sesame has been cultivated and harvested for 7,500 years.

Even today, 99% of the sesame grown in the world is harvested manually because traditional sesame capsules shatter when they dry down for harvest. In 2008, Sesaco is releasing the first Improved Non-Dehiscent (IND) varieties (Patent pending).

Traditional sesame with known traits such as drought, heat, insect, and disease tolerance is now completely mechanized by the IND genes. These traits combined provide a low input, substantial return crop for Texas, Oklahoma and Southern Kansas. These IND varieties can be left to dry standing or on the stalk in the field and will retain the majority of the seed until combined directly. While harvesting with proper combine settings, the capsules will release the seed inside the combine with minimal damage.

REASONS TO GROW SESAME

- Sesame is one of the most versatile crops that can be grown in dry arid regions. It has unique attributes that can fit most cropping systems.
- It is an easy crop to consider producing because equipment used for other crops can be used to grow sesame.
- Sesame is more profitable with limited resources than other crops using the same level of resources. It offers more return for less cost (less risk) than other crops.
- A first time grower can easily experiment with sesame because of the low input requirements without risking too much. With currently increasing input costs, this attribute alone is a major reason to grow sesame.
- Very heat, drought, disease, and insect tolerant.
- Relatively negligible economic damage from wild hogs, deer, and birds.
- Crops following sesame have increased yields with reduced production costs because of increased moisture retention and better soil tilth.
- Reduces populations of cotton root rot and root-knot nematodes.
- Low water use during the *drying phase* allows sesame to collect rainfall and store the moisture for double cropping directly after harvesting sesame.

- Brittle sesame residue will hold soil from erosion equal to higher residue crops without the hassle of excess residue balling equipment.
- It is a program crop that can be planted on cotton (or other program crop) acres and still receives the direct payment.
- In areas with limited water, farmers can stretch their water by planting part of their acres in sesame and the other part in higher moisture demanding crops like cotton, corn, or peanuts.
- Best catch crop option following hailed out cotton.
- Save money with low fertility demand.

CROP DESCRIPTION

Sesame (*Sesamum indicum*) is a broadleaf summer crop similar to cotton, sunflower, soybeans, black-eyed peas, mung beans, or guar. When planted early and under high moisture and fertility conditions, sesame can reach 4-6 feet in height. In dryland conditions, it is generally 3-5 feet, depending on rainfall.

Some varieties are single stemmed and others have branches. The fruiting form of sesame is a capsule, often called pods. They have divided sections much like a cotton boll. Some varieties have a single capsule per leaf axil and others have triple capsules per leaf axil. Branched, single capsule varieties are best adapted to the present growing areas.

Flowering starts about 35-45 days after planting and flowering stops 75-85 days after planting. The seed is produced in these capsules with about 70 seeds per capsule. The first capsule is 1-2 ft from ground. Physiological maturity (PM) normally occurs 95-110 days after planting. PM is when 75% of the capsules on the main stem have mature seed.

The plant is very leafy, but will self-defoliate at maturity. Sesame normally dries down in 120-150 days. Although sesame is indeterminate, it will terminate and self-defoliate without a frost. In most of Texas, sesame will dry down before a frost. A frost will cause the plants to drydown more rapidly than normal. Just like cotton and sorghum, a frost will terminate the crop and prepare the crop for harvest earlier than when compared to temperatures remaining just above freezing.

GROWTH AND DEVELOPMENT

There are four stages in the growth and development of sesame. Each of these (excluding the ripening phase) are divided into stages based upon growth events which can be seen and identified by the farmer.

The phases and stages of sesame are as follows:

Phase/*Stage*	**End point of stage**	**DAP/ Week** [a]
Vegetative		
Germination	Emergence	0-5 1-
Seedling	3rd pair true leaf length = 2nd	6-25 3-
Juvenile	First buds	26-37 1+
Pre-reproductive	50% open flowers	38-44 1-
Reproductive		
Early bloom	5 node pairs of capsules	45-52 1
Mid bloom	Branches/minor plants stop flowering	53-81 4
Late bloom	90% of plants with no open flowers	82-90 1+
Ripening	Physiological maturity (PM)	91-106 2+
Drying		
Full maturity	All seed mature	107-112 1-
Initial drydown	1st dry capsules	113-126 2
Late drydown	Full drydown	127-146 3

[a] DAP = days after planting/weeks in stage. These numbers are based on S26 in May 2004, in Uvalde, TX, under irrigation.

The key factors affecting the length of the various stages are as follows:

- More moisture will shorten germination and seedling stages but will lengthen the rest of the stages.
- Higher fertility will shorten seedling stage but will lengthen the rest of the stages. The effect on germination stage is unknown.
- Higher temperatures than normal will shorten the vegetative and reproductive phases.
- Cool night temperatures will lengthen the ripening phase and full maturity stage.
- Low humidity, wind, and/or heat will shorten all of the drying stages.
- Frost may and hard freeze will terminate the plants at any stage. In a freeze, even though plants will be brown in 3-5 days, they will not be dry enough to harvest for 7-10 days.

At such stages, the farmer should consider key actions. Sesame is an indeterminate species like cotton, and thus there is an overlap between the stages at different periods of the growing season. The seed in the first capsule may be mature while the upper portion of the plant is still flowering.

STAGES OF THE GROWTH AND DEVELOPMENT OF SESAME

Germination stage

Seedling stage

Juvenile stage

Pre-reproductive stage

Early bloom stage

Mid bloom stage

Late bloom stage

Ripening phase

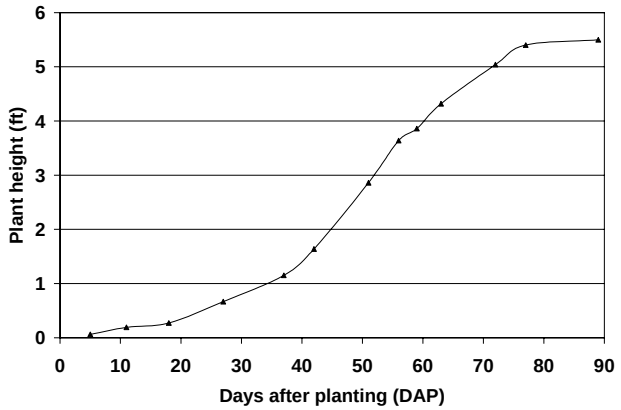
Full maturity stage

Initial drydown stage

Late drydown stage

Time to combine

Sesame is characterized by a slow growth rate in the first 30 days while the root is growing faster than the leaves and stems. The above figure shows the rate of growth of three varieties under irrigation in 2004 in Uvalde. In the first 34 days, the plants reach about 1 foot in height. It will double to 2 ft in the next 11 days, triple to 3 ft in the following 8 days, and quadruple to 4 ft in the following 9 days. At this point, the sesame will begin to canopy and the rate of growth will level off. In rainfed conditions, the final plant heights are lower, but the pattern of very slow growth followed by fast growth during the reproductive phase exists under all conditions.



Vegetative Phase

Germination

For the *germination stage* soil temperatures need to be 70ºF at planting depth at 7 AM. Final stand should be judged at 7 days after planting.

During the germination stage, a rain can create a crust in the soil over the sesame. If the seed is located inside the crust, there is no hope for emergence, and the sesame should be replanted. If the seeds are germinating below the crust, there is a possibility that the crust will crack and allow for emergence. The stage ends when the seedlings emerge.

Seedling

The *seedling stage* is a tough time for producers because of the slow pace of growth. Many first time growers have been stopped driving to the field with a disc to plow up perfectly good sesame. This stage is difficult to cultivate. The stage ends when the 3rd pair of true leaves are as long as the 2nd pair.

Juvenile

As shown in the graph before, in the *juvenile stage* there is a dramatic surge in growth. Farmers that go on vacation during this time are pleasantly surprised when they return. This is an important stage to consider beginning cultivation, sidedressing, directed herbicides, and the first irrigation. The stage ends when the first green buds are visible.

Pre-reproductive

The *pre-reproductive stage* is the most important farming stage to optimize production. This is the last chance to sidedress, let alone get a tractor into the field in good sesame. From this stage until late bloom, it is important to minimize stress to the crop. This is the optimum stage to apply the rest of the fertilizer. Applying fertilizer much after this stage may delay harvest without a commensurate return on investment. This stage ends when there are open flowers on 50% of the plants.

Reproductive Phase

The white flowers opened the day of the photo and self-pollinated. The larger yellowish buds opened the next day. By the third day after open flower, the capsules are visible and will grow to their final size about 4 days later. The speed of growth will vary by variety. The seed will be mature in each capsule from 40 days at the bottom of the plant to 25 days at the top. However, the bottom capsules will not dry until after all the capsules rippen.

Early Bloom

In the *early bloom stage,* in most cases, the early flowers will not make capsules. In sesame it is normal for the white portion (corolla) of the flower to drop off the plant in the evening. The part of the flower that makes the capsule will remain on the plant. This stage ends when there are 5 pairs of capsule nodes.

Mid Bloom

The *mid bloom stage* is the most productive stage because the main stem and branches are putting on capsules. Even though the plants flower 5-6 weeks, 70-75% of the flowers are put on the 2nd and 3rd week of flowering. Plants are pulling deep moisture at this time and from as deep as the plant is tall or deeper. At this stage, the lower leaves that are shaded will drop. This stage ends when the branches and minor plants stop flowering.

Late Bloom

The *late bloom stage* defines the last irrigation. Irrigating after this stage will be wasted or maybe even harmful in causing regrowth and/or preventing timely drydown. This is also the time to compare fields to make harvesting plans. The field that ends the late bloom stage first will most likely be the first to harvest even if it wasn't planted first. Differences in fertility and rainfall or irrigation influence the end of this stage. This stage ends when 90% of the plants have no open white flowers.

Ripening Phase

This phase is not divided into stages and technically, it starts during the reproductive phase when the first capsule is formed. During this phase, most of the leaves fall off the plants. Generally, leaves will turn yellowish green before dropping. The leaves that drop due to drought are not considered self defoliation by maturity. This stage ends at *physiological maturity(PM).* PM is when 75% of the capsules on the main stem have seed with final color and a dark tip. The seed will also have a dark seed line on one side. PM is important because after that point, the crop is less susceptible to yield loss due to frost. It is also an indicator that the time to use harvest aids is approaching.

Drying Phase

Full Maturity

The *full maturity* stage is critical because it is when desiccants are applied to help initiate the drydown of the crop. Generally, the sooner the desiccant is applied, the better chance for favorable drying conditions, and the sooner the crop is cleared from the field for the next crop. Most plants absorb the harvest aid better when there is still some active growth, and thus the desiccant is more active. This stage ends when 90% of all plants have seeds mature to the top of the plant.

Initial Drydown

During the *initial drydown stage,* new growers begin to worry about capsules opening. They are supposed to. Cotton has to open to be harvested. Sesame has to open to dry down. There will be some light seed loss out of the tips of the capsules. However, the bulk of sesame's weight is further down in the capsule and we are getting more seed in the bin than ever before from any other means. This stage ends when 10% of the plants have a dry capsule.

Late Drydown

The *late drydown stage* is the final stage we have been waiting for. The stage ends when the seed has 6% moisture and can be harvested.

The capsules will open to speed up drying. The capsule in the upper right has been cut open to show how the seeds are arranged in the capsules. Photo by Jay Simon.

FIELD SELECTION

In considering a field, the most important consideration is drainage. **Sesame does not tolerate standing water on the stems and will die**.

Growing Areas

The rule of thumb was established by Thomas Jefferson over 200 years ago: sesame will grow where cotton grows. However, just as cotton varieties have been developed for certain areas, sesame varieties need to be developed; and to date, SESACO has concentrated developing sesame varieties for the areas shown in the map above.

There are two types of sesame; sesame for dry, arid areas and sesame for wet, humid areas. Dry, arid sesame will get many diseases in wet areas, and wet, humid sesame will do poorly in dry conditions. SESACO varieties were developed for dry, arid areas.

Present SESACO sesame varieties are adapted to the following area:

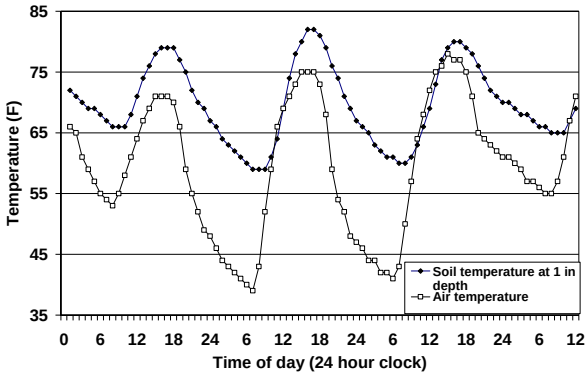
- Southern boundary: Lower Rio Grande Valley
- Eastern boundary: 50 miles east of Interstate 35 through San Antonio, Dallas, Oklahoma City, and Wichita, Kansas.
- Northern boundary: within 50 miles North of the southern border of Kansas.
- Western boundary: areas below 4,000 ft MSL to the New Mexico border.
- SESACO sesame is also grown in Arizona.

Historically, sesame is susceptible to leaf diseases east of I35 to the Atlantic Coast. The northern and western boundary limitation is caused by not having a long enough growing season in northern climates or higher altitudes.

Temperature Requirements

Sesame is a heat tolerant crop. Temperatures below optimum affect sesame more so than temperatures above optimum. Sesame has provided excellent yields in very hot temperatures (120ºF) in the deserts in Arizona and around the world. The threshold temperature for sesame is 60.6ºF[1]. When night temperatures go below the threshold, it takes longer for the crop to mature. Rule of thumb is that you need 130 days from the time that the soil temperature is 70ºF and the first frost date.

Sub-optimum temperatures during planting and germination are a common issue when trying to plant as early as possible. To see if it is planting time, take the planting depth soil temperature in the morning. ***Sesame needs 70ºF soil temperatures to plant***. Watch for cold fronts or rain in the forecast, which will lower temperatures down again. As shown below, the daily swings in the temperature can shift as much as 23ºF for soil temperatures and 30ºF for air temperatures in April in Batesville, TX.



Early planted sesame generally gives the best yields and the fewest pest problems!!! However, planting too early can reduce yields because the seedlings will grow slowly in the cold weather. The rule of thumb is "if you have to wear a jacket in the morning, it is too cold to plant." A second rule of thumb, "Sesame needs about 5 more degrees than cotton for good stand establishment."

Planting in South Texas is usually from mid March in the Valley and mid April in the Wintergarden area. In the Rolling Plains and central Oklahoma, it is from mid May. On the Caprock, it is from late May. It is more important to watch temperatures and not the calendar date.

[1] Angus, J.F., R.B. Cuningham, M.W. Moncur, and D.H. Mackenzie. 1980. Phasic development in field crops I. Thermal response in the seedling phase, Field Crops Research 3, p. 365-378.

Volunteer sesame can fool you in that it can germinate during a warm spell in March from shallow depths, which are much warmer than planting depths. Farmers have then gone out and planted and not had a stand.

Since 1987 in Texas and Oklahoma, sesame planted before June 15th has escaped problems with early frosts in all years and before July 1st in most years. Last planting date should be by 4th of July. After that date, yields and seed quality are at risk. In areas with severe whitefly such as the Lower Rio Grande Valley, sesame should be planted prior to May 1 to have the sesame ripening before the whitefly cycle increases, when a single whitefly can become between 22,500 to 90,000 whiteflies in 32 days.

From planting, sesame needs about 110 days of night temperatures above 40ºF. Sesame needs to reach physiological maturity prior to frost to make optimum yield.

Soil Requirements

Sesame grows best on medium to light, well-drained soil. Heavy clay soils require good drainage or raised beds and light irrigation. It prefers slightly acid to alkaline soils (pH 5-8) with moderate fertility. It does not like salt. Cotton and alfalfa are more salt tolerant.

Herbicide Residues

Sesame is NOT a grass type grain. It is a broadleaf like sunflower, cotton, and soybeans. The majority of the herbicides used in the previous crop season do not cause problems, but if sesame is to follow a failed crop, there are potential problems.

- **No problems** – alachlor (Intrro), diuron (Direx), linuron (Linex), and metolachlor (Dual Magnum). Burn-down herbicides such as glyphosate (Round-up) and glufosinate (Ignite) are used widely. ***2,4D and other phenoxy herbicides*** have been used for early burn-down, but if used just prior to planting or after planting/before emergence, they can destroy a stand.
- **Few problems** - Many acres of sesame have been grown following hailed out cotton. Sesame has been planted after trifluralin (Treflan), pendimethalin (Prowl), and pyrithiobac (Staple). Normally, by the time of the cotton hail out, these herbicides are not as potent. Using these herbicides, just prior to planting, will reduce stands.
- **Mixed results** - There have been mixed results after prometryn (Caparol) with those farmers moving the hot zone away from the seed line being successful. In peanuts, sesame has followed imazapic (Cadre) or imazethapyr (Pursuit), but in years of low rainfall, the stands have been reduced substantially.
- **Poor results** - Wheat herbicides (in the sulfuron family such as Amber, Glean, Ally, Finesse, and Assert) applied to control broadleaf weeds have caused injury ranging from complete stand destruction to little damage. Corn and sorghum herbicides, such as atrazine, are generally detrimental.
- Monitor rainfall or irrigation since the herbicide application because these herbicides could have been dispersed, diluted, or moved from the sesame root zone. At least conduct a field trial by hand planting sesame in various locations of the herbicide treated land to test emergence.
- Be careful with newer, longer residual herbicides in your previous crops - if cotton is NOT OK on the label, don't try it for sesame. There are also herbicides that are very selective to specific broadleaf vegetables and lethal to other broadleaf species.

Rotations

Sesame as a primary crop. Sesame is regularly planted after cotton, corn, sorghum, peanuts, alfalfa, soybeans, wheat, oats, onions, and rye without any problems. There have been successful rotations with other vegetables.

Sesame as a second crop after wheat. In irrigated or high rainfall areas, sesame provides a good second income, just prior to Christmas, with yields close to using sesame as a primary crop. In the dryland Rolling Plains and Oklahoma, many farmers plant sesame as a second crop after wheat. In some years, with a few summer rains at the right time, sesame after wheat has yielded over 800 lbs/acre in the San Angelo area. In most years, sesame will more than cover its costs and provides soil and yield benefits to cotton and wheat the next year. In rare years, there will not be enough moisture, but the sesame can be disced in as a green manure to provide soil and yield benefits to cotton and wheat the next season.

Sesame as a catch crop for failed out cotton. Sesame has been planted on tens of thousands of acres after failed out cotton in Texas and Oklahoma. The sesame cycle is about 30 days shorter than cotton and thus can be planted later than cotton.

Sesame as a catch crop for failed out corn or sorghum. Usually does not work because of the herbicides.

LAND PREPARATION

Good land preparation is essential for a good stand since the sesame seed is small. Whether using

conventional or no-till methods, having a proper seedbed with sesame is always critical.

Row versus drill planting, row spacing, and patterns

Optimum row spacing is from 15" to 40". Both row planters and modern drills can achieve good stands. Most sesame planting in predominantly cotton areas has been done with row planters, while predominantly wheat areas use drills. The wider the row, the more likely the farmer is able to cultivate for weed control.

The advantage of using planter units is the ability to use various planter attachments. Set properly, these attachments will remove thick layers of dry soil to place the seed into moisture. Various planter covering systems can replace a light dry cover back over the seed trench.

Drills have been set with wide spacing in cases where cultivation is desired and on beds. Planters and drills have been used to accomplish double row planting with or without beds. Wider row spacing is used when planting earlier or in drier areas. Narrower row spacing is used when irrigation is possible, in higher rainfall areas and when planting closer to the end of the planting window.

At present date, no varieties respond well for below 15" row spacing. Two and one row patterns on 30-40" rows most often limit yield. Skipping one row between a pass can be convenient to match the traditional cropping system or header widths.

Raised Bed Planting

Planting in or on preformed raised beds has its advantages. A raised bed provides a storage bank of moisture protected by a cap of dry soil until temperatures rise to a sufficient level. With the proper equipment, the dry soil cap can be removed to find ideal planting moisture. When the bed is moist, minimal soil removal is needed. When it is dry, more soil can be removed without placing the seed into a trench that would hold standing water directly on top of the seed.

Planter unit attachments should be used to remove most of the dry soil but not all. Removing all of the dry soil and exposing moist soil may cause baking of the soil crust. After heavy rains or in heavy soils, water is drained into the furrows away from the seedlings causing better aeration in the soil, which sesame needs, and reducing wet and cool seedling disease pressure. Sesame does not survive well in saturated soils. It is more sensitive to saturated soils than cotton. Periods of saturated soils that turn cotton yellow in low lying areas will kill sesame. Rows provide a way for excess moisture to be drained from the seed zone.

No-till and Strip-till

Whether with a row planter or drill, no-till planting provides another way to protect adequate moisture for planting sesame at shallow depths. The basic principles of no-till are beneficial to planting sesame. Surface residue shades the ground to hold shallow moisture near the surface for a longer period of time so that more acres may be planted before the soil dries out. Additionally, the residue prevents evaporation, seedling damage from blowing sand, and soil erosion from wind.

No-till practices provide a firm seedbed in which to place the seed and reduce what is known as seed drift in the seed trench that occur in soft tilled soils. When strip tilling, be cautious of disturbing the seedbed too much and only clear the surface for increasing seed zone temperatures, immediate light reception at emergence, and increased herbicide-soil contact.

Row planter planting into wheat stubble

In planting after wheat harvest, the height of the stubble can affect the sesame. If using a bed planter with large gauge wheels next to the seed line, the stubble will be pressed down, allowing light to the seed line. Without sunlight, the sesame seedling will grow very slowly at best. With most drills, there are just soil openers, and the stubble has to be mowed, or the combines have to cut lower. In 2000, in a normal wheat stubble field, half the field was planted with mowing and the other half without. Both sides had equal emergence, but only the mowed side was harvested. The plants on the other side never grew above the 12" stubble.

Conventional Tillage

Conventional tillage has its advantages as well as cautions to be aware of. Sesame is a deep-rooted crop, and hardpans will reduce yields. Deep tillage breaks hardpans in the root zone. But, deep tillage, just before planting, is highly discouraged. Deep tillage should be done with sufficient time for rainfall or other

seedbed firming equipment to prepare the seedbed for proper planting conditions.

Clean tilling increases soil temperatures, insures a weed free environment to start the crop, and removes residue that may tie up herbicides. Planting into soft tilled soils may result in seed drift. Sesame is small enough to move considerably in large fractures in the soil when not using much down pressure on planting units or covering systems.

In conventional tilled ground, a shallow mulching is recommended to get rid of weeds from the seedbed and seal in moisture. The mulch should be as shallow as possible to keep the moisture near the surface and prevent soil from blowing. A light irrigation or shower after the shallow mulching is beneficial to firm the seedbed as well. **Understanding the depth of the moisture is critical.**

VARIETY SELECTION

- Rio Grande Valley TX: S26
- Uvalde TX area: S26 for dryland; S26/S28 for irrigated
- Rolling Plains (San Angelo TX thru Altus OK): S26
- Caprock TX: S25/S29
- Oklahoma: S25/S29
- There is one new variety: S32. This can be used on limited acres in all areas except the Rio Grande Valley.

For further information see Appendix 1.

PLANTING SESAME

First time growers should consider all production techniques used to grow sesame. The variations in sesame growing practices are as diverse from neighbor to neighbor as they are from Southern Kansas to the Lower Rio Grande Valley. This is a case where techniques used 600 miles away may actually work for you as well.

Planting is the most critical aspect of growing sesame. A farmer can do nothing to improve yield on poor stands except replant. Planting sesame is management of adequate moisture and temperature to establish a strong stand advantage for sesame to compete against weeds for light, moisture, and nutrients before residual herbicides wear off.

Experienced growers testify that planting is the most challenging aspect of growing sesame and that the best way to become educated is with experience. Once a grower grasps the planting concepts, good stands are easy to achieve. Growers quickly gain confidence by following a few techniques and paying close attention to their moisture levels. SESACO research continually evaluates varieties on their ability to emerge quickly and under tough conditions.

Planting Concept

No matter what equipment is used, the overall goal is proper seed placement in moisture. Whether a conventional drill, no-till drill or planter, the philosophy is the same: minimize seed depth to reduce the amount of time for emergence, and yet place the seed deep enough to ensure the seed will not dry out before emergence.

In most cases, this can be described by placing the seed 1/2 inch to 3/4 inch below the defined moisture line with a 1/4 inch to 3/4 inch dry covering of dry soil above that line. The total seeding depth would be from 3/4 inch to 1.5 inches. It is preferred to be less than one inch if possible. For shallow planting, cotton growers that use this same philosophy, the planting seed depth adjustment may only be 1 or 2 clicks or notches shallower than where they plant cotton. The sesame seed is small and has less push than cotton, peanuts, wheat, sorghum, soybeans, or mung beans. It needs less cover and compaction than most other field crops.

The following cautions are true for all types of planting:

- It is essential to have good moisture at planting – as good as or better than cotton. The seed needs to have moisture around it for 3 days (late planting/warmer) to 5 days (early planting/cooler).
- If a planting rain follows a drought, make sure that the top moisture has joined the bottom moisture. No root will push through dry dirt.
- Do not fill boxes above 6-8” because the seed will grind, cake up the planting units, and lower germination.
- Slow down to increase uniformity in seeding depth; a high speed will bounce the planter units, resulting in the seed being too deep and too shallow.
- Put as little pressure as possible on the packer wheels in accordance with soil types.
- Recheck depth settings in different parts of a field; check again in same field if there has been a strong sun and/or wind drying down the soil; check again the next day or when moving into a new field.

Planting Seed Equipment and Settings

See Appendix 2.

Row Unit Attachments

As stated before, various row unit attachments made to go mainly on planters can benefit sesame. Removing excess dry soil and residue to provide a

better seedbed is often needed. Be careful to not enter into the moisture layer that will cause "caking" of gage wheels that will lead to placing the seed on the surface and not in the trench. Also, this can cause severe baking by exposing the moist soil to the sun.

Press Wheels and Covering Systems

Most planter unit covering systems have been used with sesame. Release most all pressure with just enough to ensure proper covering. The idea is to leave a dry thin layer of soil above seed in moist soil. Sometimes a chain is dragged behind the unit to remove any excess dry soil and covering where the wheels may have missed. Leaving an open trench will lead to the seed drying out. Even if the seed does not dry out, the cotyledons will open below the level of the soil, exposing them to being covered by running water from heavy rains or blowing sand.

On grain drills, the single press wheel should be careful to cover the seed without adding too much pressure causing compaction on top of the seed. Of the types of single press wheel systems, the wider double ribbed type will help reduce compaction directly above the seed trench.

Be careful with the large cast iron covering wheel of the JD 90 series opener. The wheel does not compact the seed but in soft soils may apply too much soil above the trench. It is excellent in no-till high residue conditions.

Planting Seed Metering Equipment

Most metering mechanisms used to date have worked successfully when maintained, set and calibrated properly. This includes plate planters, vacuum planters, volumetric drill meters, and air drill meters.

Only the vertical plate with brush meters in planters and double run meters in drills have not worked with sesame. The White Air System was successfully used in 2007 with farmer made plates.

Dry Planting

Planting dry is a dangerous proposition and most often does not work. The issue is where the sesame seed is in relation to moisture, weed seeds, and herbicides.

If the sesame is planted shallow in dry conditions and receives a rain, it may become baked inside the crust at the surface. Because sesame seeds are small, they may not have the energy required to break that crust. If the soil is dry for a few inches and shallow planted sesame receives a rain, it may germinate - but then dry out before reaching the moisture further below and becoming established. Many times dry planting sesame does not establish a stand sufficient to compete with weeds. It is best for all sesame seeds to germinate at once and quickly to compete with weeds.

Giving weeds any head start in sesame is failure waiting to happen since there is no economical total control of broadleaf weeds once sesame has emerged. Depending how much of an advantage the weeds may have on the sesame, there is an economical limit to what can be accomplished.

Again, planting sesame is a timing of adequate moisture and temperature to establish a strong stand to compete with weeds for light, moisture and nutrients before residual herbicides wear off.

The newest air seeders work well in sesame

Buster Planting

Like "Dry Planting", buster planting is a hazardous proposition and often does not work. It has had excellent success in the right conditions as well. The issue here is that planting sesame in a furrow exposes it to potential of being flooded out with just a small rain. In windy areas, blowing sand can cover the emerged seedlings. Buster planting should only be attempted in light sandy soils that have high infiltration rates or a forecast with a high probability of no rain for 10 days.

Planting Rates

Most farmers plant between 2.5 to 4.5 lbs/ac, depending on row spacing and planting conditions. The cheapest insurance for sesame is to plant enough seed the first time.

Over-seeding is much better than under-seeding. Sesame can adjust to the population. If the population is too high, it will self-thin itself in most situations. In low populations, it will branch more to fill the spaces. There have been no statistical differences in yield between 3-8 plants per foot at harvest in studies on 30", 36", 38", and 40" row

spacing. ***Seed per foot of planted row is more important to yield than population per acre.*** Meaning fewer rows with more plants has proven better than more rows with fewer plants.

Planters are different and can be set differently; soil compositions are different; soil moistures and temperatures are different; as with all crops, every farmer does something a little different. Not all planters used to plant sesame will be set the same. The following is a starting point for new farmers.

For average conditions, plant 25-35 seeds/ft. ***Seeds are small; together, they help to push up soil and emerge. Planting less seed/ft usually ends up in skips***. Expect emergence of 11 to 19 seedlings/ft, and expect harvest population of 5-10 plants/ft.

Plant more (30-40 seeds/ft) when planting
- Deeper
- Under compaction
- In cloddy, trashy soil
- In cooler temperatures
- In less than good moisture
- When soil changes within a field
- In fields with hills and low spots

Plant less (20-30 seeds/ft) when planted
- In well prepared soil with good moisture
- With no herbicides
- When soil temperatures reach 80 degrees

Calibrating your planter is critical. It is not critical to the level of knowing the exact seeds per foot like in current high valued crops, but it is easy with small seed to be off by a pound or two. Take the time to calibrate your planter properly. Make repairs where needed. A worn metering cup is like a worn spray nozzle putting out too much. A shot in the dark can be a shot in the pocket book when you run out of seed or don't put out enough seed to make a stand.

For S26 and S28, the following table shows the number of lbs/ac planted depending on number of seeds/ft and row spacing, e.g., planting 30 seeds/ft on 36" rows, will use about 3.1 lbs/ac.

Row space	Seeds per ft planted					
	15	**20**	**25**	**30**	**35**	**40**
40"	1.4	1.8	2.3	2.7	3.2	3.7
36"	1.5	2.1	2.6	3.1	3.6	4.1
30"	1.8	2.5	3.1	3.7	4.3	4.9
22"	2.5	3.3	4.2	5.0	5.8	6.7
15"	3.7	4.9	6.1	7.3	8.6	9.8
	5	**8**	**11**	**15**	**19**	**24**
	Seeds per ft normally emerged					

When calibrating with S25 seed which is smaller, the lbs/ac used will be about 4-6% less, but if the same settings are used, then more lbs will be planted. For example, in some air systems, 1-2 S26 seeds will be isolated, and then 2-4 seeds may be picked up with a variety with smaller seed. Note that the greater the number of seeds/ft planted, the higher the emergence percentage. Two common errors are not checking seed depth for all planter rows and not adjusting planter setting to changing field conditions. Many times planting rates are best decided on the planting conditions of the day and location.

With the advent of air seeders, farmers continue to ask the optimum population per acre and the germination rate to try to plant one seed per unit area to achieve the optimum population. A sesame seed by itself does not have enough push to end up with a perfect stand. You absolutely need to plant more seeds in order to make sure that in tough conditions, there is enough of a population to cover the ground and produce economical yields.

For those that still want to know optimum plants per acre, in numerous yield analyses, SESACO has found little difference in the yields of populations between 40,500-105,200 pl/ac with lines that adjust to the population, i.e., produce more branches in low populations. When the stands are uniform, even lower populations plants can provide equal yields, and when there is adequate moisture and fertility, much higher populations can still yield well. In Texas, Kinman and Martin (1954)[1] found little difference in yield between 10,100-198,300 pl/ac because of high stand tolerance. In Australia, Bennett (1998)[2] strives for 121,400-141,600 pl/ac and Sapin et al. (2000)[3] recommend 80,900 to 161,900 pl/ac. In Venezuela, Avila (1999)[4] found little difference between 121,400-141,600 pl/ac.

Again, it is better to have more plants than not enough.

[1] Kinman, M.L. and J.A. Martin. 1954. Present status of sesame breeding in the United States. Agron. J. 46(1):22–27.
[2] Bennett, M. 1998. Sesame seed. The new rural industries, a handbook for farmers and investors. www.ridc.gov.au/pub/handbook/sesame.html.
[3] Sapin, V., G. Mills, D. Schmidt, and P. O'Shanesy. 2000. Growing sesame in South Burnett. Department of Primary Industries, Queensland Government, www.dpi.qld.gov.au/fieldcrops/ (No longer on internet).
[4] Avila M., J.M. 1999. Cultivo del ajonjoli, *Sesamum indicum* L. Fondo Nacional de Investigaciones Agropecuarias, Maracay, Venezuela.

WEED MANAGEMENT

Keep fields as clean as possible of johnsongrass, mintweed, wild cucumber, sunflower, kochia, and ground cherry. These are difficult to clean out of sesame. Sesame delivered with seed from these weeds is subject to price discounts.

Herbicides

Presently in the US there are only two herbicides labeled for sesame:

- RT3 (glyphosate) is a burn down herbicide and can be applied before, during, or just after planting. Broadcast must be done before the crop emerges. Wiper applicators or hooded sprayers can be used between the rows after the crop has been established.
- Select Max (clethodim) is a grass herbicide and can be sprayed at all stages except during flowering.

The American Sesame Growers Association (ASGA) is currently supporting herbicide research at Texas A&M, Texas Tech, and Oklahoma State Universities. Preemergence (PRE) experiments have shown that metolachlor (Dual Magnum), under most conditions, provides good control of grass and small seeded broadleaf (pigweed) weeds. There have been only 2 experiments worldwide that shown substantially reduced sesame stands when using Dual. In one study Dual was applied preplant incorporated, and in the other study, Dual was applied after planting and immediately followed by a heavy irrigation. ASGA has requested a Section 18 for use of Dual Magnum in Texas and Oklahoma for 2008. Initial work has also shown that diuron (Direx) and linuron (Linex) are also good PRE herbicides, and verification in 2008 may lead to requesting a Section 18 for those products in 2009.

Applying glyphosate between planting and two days after planting has reduced germinated weeds without affecting the sesame stand. However, an application of 2,4D or carfentrazone (Aim) as a burndown herbicide has destroyed sesame stands.

The work on “postemergence over the top” (POST OTT) applications of herbicides for grasses has shown many herbicides that work. There are flushes of grass that can come up later in the season and grow lower than the sesame. Although the sesame has plenty of light, the fibrous roots of grasses are very efficient at absorbing the rain and not allowing it to reach the sesame roots. These grasses may also delay harvest and should be controlled.

There is still no good POST OTT herbicide for broadleaf weeds. Most herbicides that kill broadleaf weeds will also kill or damage the sesame. In some areas of the world a second PRE herbicide has been applied over the top to extend the longevity of the PRE activity. Other work includes POST directed sprays.

ASGA supported a study of world wide research and use of sesame herbicides. The study can be accessed on the internet at http://sesamegrowers.org/herbicide-research.htm. The following herbicides are used in farmer sesame fields in Asia, Africa, Central America, and South America:

- **PRE**: alachlor (Intrro), diuron (Direx), fluometuron (Cotoran), glyphosate (Roundup), linuron (Lorox), metolachlor (Dual magnum), pendimethalin (Prowl), and trifluralin (Treflan). [Extensive work in the US on pendimethalin and trifluralin have indicated that full rates recommended for cotton will reduce stands on sesame unless they are applied in early Spring that allows the product to break down to an acceptable level.]
- **POST OTT**: clethodim (Select), diuron (Direx), fluazifop-P (Fusilade), haloxyfop (Verdict), and sethoxydim (Poast).
- **POST DIR**: glyphosate (Roundup, RT3) [only between rows- not directed on the stems], diuron (Direx).

ASGA will support work on the following herbicides in 2008:

- **PRE**: alachlor (Intrro), diuron (Direx), fluometuron (Cotoran), linuron (Lorox), metolachlor (Dual magnum), propazine (Miloguard), and diuron + linuron (LaybyPro).
- **POST OTT**: diuron (Direx), linuron (Lorox), fluometuron (Cotoran), propazine (Milogard), and diuron + linuron (LaybyPro).
- **POST DIR**: diuron (Direx), linuron (Lorox), fluometuron (Cotoran), propazine (Milogard), prometryn (Caparol), flumioxazin (Valor), and diuron + linuron (LaybyPro).

Glyphosate and 2,4D drift

Sesame is extremely susceptible to drift from Round-up Ready Crops. The yields adjacent to cotton fields have dropped by as much as 50%. The amount of damage to a field depends on the wind speed with some drift affecting the sesame 100 feet from the cotton. The plants will yellow and will not make capsules for 1-3 weeks. When capsule formation does begin, the capsules will be smaller and will have less seeds and seed weight. The affected plants will continue flowering longer and can delay harvest of the rest of the field.

The amount of damage from 2,4D has not been quantified, but the plants near peanut fields will have twisting stems and will not make capsules for 1-3 weeks.

There is little experience of sesame near Liberty Link crops, but sesame is very susceptible to glufosinate (Ignite).

Cultivation

In the absence of herbicides or clean fields, cultivation is the best option. Cultivation has been used successfully in the US since 1978.

Cultivation should be done at 3-4 weeks after planting before it gets too tall. Sesame tolerates throwing dirt up on the stalks - helps control small weeds coming in seed line and deepens irrigation furrow. If plants look yellow from cold or too much rain, cultivation will help green up sesame.

The sesame roots follow moisture. If there is rain or a pivot is used in first few weeks after planting, the roots will grow laterally. Cultivating too close to the plant will cut the roots.

Sesame can be cultivated when it is a little taller than tractor axle, but it should be done in afternoon when the plants are less turgid. The flowers will fall, but this is natural, and the whole fruit or young capsule is rarely knocked off by the tractor.

FERTILITY MANAGEMENT

The best sesame yields are on fields that are fertilized with balanced NPK fertilizers!! Anhydrous ammonia applied the previous year for wheat is not going to be enough.

Sesame is deep rooted and will scavenge for fertility below the wheat root zone, but that only works once. The sesame will strip that lower reserve, and the fertility will not be available for future sesame crops.

The rates vary with soils, rainfall patterns, and local farming practices. There is little work on PK rates and most farmers use the cotton recommendations for their soils. Work has shown that PK is critical for high yields, particularly in acidic soils. The following is a general guide for nitrogen.

Amount of moisture	Units of N/ac
Dryland under 28” annual rainfall	25-35
Dryland over 27” annual rainfall	30-60
Full irrigation (10-12”)	60-80
Semi-irrigation (6-8”)	40-60
Semi-irrigation (2-4”)	30-50

Ideally, half of the fertilizer should be applied pre-plant and the other half when the buds are showing up in the *pre-reproductive stage*. Applying all of the fertility up front can lead to leafy tall plants that will not yield as well as they look. The moisture and fertility ends up being used in the stems and leaves instead of filling seed.

When having to apply all of the fertility up front, a slow releasing fertilizer should be used. Using a full rate of anhydrous ammonia up front has not worked because it is not available at the critical time when the plants are producing seeds.

In some pivots, the fertility can be added with the water. In most situations this is ideal, but in dry years, there is less microbial action to change the nitrogen into a form that can be used by plants.

If wheat stubble is burned off, use recommendations above. If wheat is disked in or if there is still considerable stubble from corn or sorghum, use an extra 20 units/ac pre-plant because the stubble ties up the N.

Do not plant fertilizer in the seed line with the seed! The fertilizer will disintegrate the seed. Applying the fertility during planting below or to the side of the seed line has worked well.

Sesame seed contains about 25% protein, and it is estimated that 1,000 lbs of sesame seed contains 18 to 21 lbs of N. The plants (without the seed) on a 1,000 lb crop per acre will have about 30 lbs of N, which will go back into the soil at harvest.

WATER MANAGEMENT

Three options: (1) go dryland, (2) go fully irrigated, (3) go semi-irrigated: pre-irrigation and 1 irrigation at 6-7 weeks. In many areas with scarce water, option (3) has been the best strategy.

Close to 85% of the sesame grown in the US is under dryland conditions or does not receive irrigation. Most of it is grown in low rainfall areas during the summer which is the dry season. It is important to conserve as much moisture as possible. Every pass with a piece of tillage equipment takes moisture out of the ground. Many farmers are now burning down the weeds with herbicides. This not only stops the weeds from depleting moisture but also provides shade to the ground to conserve moisture. One caution: in burning down just prior to planting, in heavy infestations of weeds such as pigweed, the taller pigweed will shelter the smaller pigweed from the spray. The taller will be killed, but the lower will have to be sprayed a second time.

Sesame uses less water than cotton, corn, sorghum, soybeans or peanuts. ***Stretch your limited water with sesame!***

Sesame is one of the most drought tolerant crops in the world but will give higher yields with higher moisture. Yields are based on total amount of water in the soil profile before planting and the rainfall or

irrigations between planting and physiological maturity. Rains after the *ripening phase* do not increase yield and may delay harvest.

Irrigating in the late juvenile stage just before visible buds

A heavy pre-irrigation is the best water the sesame will get. The moisture profile at planting time is the determinant of post-plant irrigations. If there is a poor profile, more water will be necessary.

For furrow and pivot irrigation, the number of irrigations and interval depend on soil. Lighter soil needs earlier and more irrigations.

For furrow irrigation:

- Prefers fast, light irrigations. A short run or some slope helps.
- On pre-irrigation, block the ends and stack up the water. On other irrigations, let water drain out of end.
- Harrowing or burndown herbicides will kill the weeds that germinate.
- With pre-irrigation and no rain, first irrigation at 4-5 weeks, with 1-2 more irrigations 10-16 days apart.
- Watering every other row has worked with good beds.
- 2 or more inches of rain at the right interval are a substitute for an irrigation.

For pivot irrigation:

- On pre-irrigation after the heavy tillage is complete, apply 2 to 4 inches, depending on amount of moisture in soil profile.
- Harrowing or burndown herbicides will kill the weeds that germinate.
- With pre-irrigation and no rain, first irrigation at 4-5 weeks, with 2-3 more irrigations 7-12 days apart.
- Use 1 to 1.5 inches per application.
- 1.5 or more inches of rain at the right interval are a substitute for an irrigation.
- If no pre-irrigation and the moisture profile is only 1-2 feet deep with dry soil below, do not use more than 0.5 inches per irrigation. In this situation, the roots are very shallow and a heavy irrigation will not move the moisture deeper and will suffocate the roots.

Look to the plant to tell you when to water. Do not worry if plants droop in hot afternoon. When the leaves wilt by 2:00 PM, the plants will need water soon. Do not pay attention to top moisture; the taller the plants, the deeper they draw their moisture. There are times when the soil at the surface is muddy and there is little moisture deep where the roots are taking up moisture.

Stop irrigating in the *late bloom stage* which occurs between when the branches and minor plants stop flowering and when 90% of the plants do not have an open white flower.

Going into a low moisture soil profile with a light pivot irrigation to get the sesame up and then trying to keep up with the moisture requirements by additional pivot passes has not worked. Sesame likes to root deeply following the moisture. Maintaining moisture at the top will keep the roots shallow and not go deep. With shallow roots, both extremes are deadly: letting the soil around the roots dry out or adding so much water that the roots suffocate and the plants die.

If the plants start with high fertility/moisture, they will need an irrigation within 28-35 days of planting. If stressed too much, they will lose leaves and late/full irrigation will not give highest yields. If plants start with low fertility/moisture, some irrigation will help, but full irrigation is not cost effective.

Late irrigations are better than no irrigations but will not yield as much as timely irrigations. Many farmers do not irrigate until finished with watering corn, cotton, and/or peanuts. If irrigating late, call SESACO and discuss whether late irrigation is worthwhile – the answer will depend on preplant soil moisture profile, row spacing, population, rains, and previous irrigations. Under some conditions, a late irrigation will reduce yield. ***Do not try first irrigation after 6 weeks***, unless (1) preceded by good rains, (2) very low pivot rates are used (less than 0.5”), or (3) first irrigation is also the last.

Watering up or watering back to help a poor stand seldom works and brings on weeds.

Under-irrigation is much better than over-irrigation.

DISEASES

Through plant breeding, present varieties have incorporated tolerance to all diseases encountered since 1978.

Cotton root rot (*Phymatotrichum omnivoum*). Sesame is not susceptible to cotton root rot, and cotton is not susceptible to sesame root rots.

Sesame root rots (combination of *Fusarium oxysporum*, *Phytophtora parasitica*, and *Macrophomina phaseolina*) have been encountered mostly on fields where sesame is planted after sesame. The current varieties are tolerant but not resistant to the root rots. The best way to avoid sesame root rot is to rotate every other year.

An unidentified leaf disease (probably *Pseudomonas*) has appeared in several years when there are cloudy damp cool days, but the plants have grown out of the problem when sunny days return, and there has been no economic damage.

Rhizoctonia, *Helmintosporium*, *Thielaviopsis*, *Verticillium*, *Cercoseptoria*, *Cercospora*, *Pseudomonas*, *Cornespora*, and *Leveillula* have been reported in sesame in the US in research nurseries, but have not been seen in commercial fields since 1978. A new type of *Alternaria* was seen in 2006 on the Caprock in both sesame and cotton but did not repeat in 2007.

INSECTS

Through plant breeding, present varieties have incorporated tolerance to all insects encountered since 1978. Since 1978, less than 5 fields have been destroyed by insects and less than 10 have had significant economic damage. All of these problems occurred prior to 1994 and were on fields planted late. Normally, the beneficial populations of insects control the few insects seen. With less spraying on cotton because of the boll weevil eradication program and transgenic (Bt), the populations of beneficial insects have increased.

Cotton aphid (*Aphis gossypii*). Sesame is not susceptible. In many years in fields with both crops planted side-by side, the cotton 40" away from the sesame is covered with honeydew while there are no aphids on the sesame.

Silverleaf whitefly (*Bemisia argentifolii*). When the silverleaf whitefly appeared in 1991, the varieties were very susceptible. Since that time, white fly tolerant varieties have succeeded when planted on time. The appropriate planting dates per area are covered in Appendix 1. North from Uvalde, the whitefly populations have never built up to pose a significant economic threat to sesame. In the Lower Rio Grande Valley of Texas, sesame planted after 1 May is susceptible to the whitefly in every year. In the Wintergarden area, late planted sesame (after 1 June) is susceptible to the whitefly in a hot dry year. Rains appear to suppress the whitefly. Newer varieties have more tolerance to white flies. In 2000, a year with very high whitefly populations, there was very limited whitefly damage in Uvalde.

Beet army worm (*Cupis unipuncta*). In 1995, in the Rolling Plains, the army worm did not attack the sesame where cotton and alfalfa were devastated next to sesame fields. In the Fall of 2006, army worm devoured pigweeds within the sesame field before moving to retire on the sesame.

Cabbage loopers (*Pieris rapae*). In 1995, in the Rolling Plains, the loopers did not move into the sesame, although loopers have done some damage in the San Angelo area in previous varieties.

Green peach aphid (*Myzus persicae*). Previous varieties of late planted sesame were susceptible to the green peach aphid (*Myzus persicae*) – the major aphid in pecan groves. No economic damage from aphids has been seen in sesame since 1992.

Bollworms (*Heliocoverpa zea*) and **garden webworms** (*Achyra rantalis*) have been seen in sesame but damage has never reached an economic level.

Grasshoppers (*Trichoplusia ni*) can damage the edges of the fields near pastures in dry years.

Most pesticides are not labeled for sesame. Bt (Bacillus thuringiensis) and neem (Axadirachtin) are cleared for use on sesame.

HARVEST

Understanding the principles of sesame harvest is the key to easing harvest time tensions. Once you understand these principles, you will agree that SESACO sesame is one of the easiest crops to harvest. Although SESACO has made huge accomplishments in the harvesting of sesame, a timely harvest will always maximize yield.

Sesame self-defoliates without a chemical. A harvest aid can reduce time to dry down allowing earlier harvest earlier.

Moisture Matters

For best yields, sesame must be harvested as soon as crop moisture falls below 6%. **HARVESTING SESAME BELOW 6% IS CRITICAL. DO NOT TAKE THIS LIGHTLY.** In any way possible, you should not minimize the importance of obtaining proper moisture on sesame. Sesame has 50% oil and 6% moisture in sesame is equivalent to 12% moisture in corn. Sesame cannot be cost-effectively dried once it is combined.

Reaching 6% moisture **IS NOT DIFFICULT.** The crop should not be rushed or it will cost the grower to have a lower grade resulting in price discounts. A few days of patience may be all it takes. High moisture sesame is often caused by negligence from the grower. It is the most common reason for a grower to receive a price discount or even for a load to be rejected. It is well worth the effort of sampling a field for moisture at the elevator.

No Swathing, Only Direct Harvesting

SESACO sesame is harvested directly. It is not swathed prior to combining. As sesame matures and dries down, it will self-defoliate. Swathing has been tried and rarely works and results in price discounts. Since 2000, only 100 acres of sesame have been swathed, and the results on the 100 acres were poor.

Harvest Aids

There are no harvest aids labeled for sesame. Preliminary work with Texas A&M and Texas Tech Universities has shown that desiccant harvest aids may become a useful tool. There is some consideration to seeking a Section 18 for diquat (Reglone), and there is more testing being done with glyphosate (Round-up) and glufosinate (Ignite). Initial experiments showed that timing of harvest aids can become critical. Applying the harvest aid prior to physiological maturity can lower yields by as much as 10%.

Sesame does not need a harvest aid prior to a freeze like cotton to open capsules. The combine will take care of threshing out the seed from a dry capsule. It does not have to be opened chemically.

There are 4 reasons to consider a harvest aid:

- Accelerate the drydown. In the last 3 years the *drydown phase* has ranged from 20 to 51 days. Some of the newer varieties are averaging 24 days. It takes 10-18 days for a desiccant to dry sesame and thus, acceleration may not be a cost effective method.
- Burn down green weeds. This is the major use of desiccants. Green weeds add moisture to the combine bin no matter how dry the sesame plants are, and the weeds may still be growing.
- Evening up a field with two levels of drydown. Many fields have low spots that will still be green while high spots are drying. In some cases, some seeds were left dry at planting and germinate with the first rain, making for two ages in the field. Applying a harvest aid can bring the field to a more uniform drydown.
- Stopping regrowth. There are some varieties (S25 and S29) that have a tendency to stop flowering when they run out of moisture/fertility and then after a rain, begin flowering again. In most lines, the regrowth will start on new branches that emerge from the base of the plant. On these plants, the main stem and early branches will ripen and dry while the green from the regrowth will prevent harvest. The new seed in the regrowth will never exceed what is lost from the early dry capsules.

PHILOSOPHY OF OPERATING A COMBINE IN SESAME

Sesame is one of the gentlest crops on harvesting equipment. There is no one setting for a combine that will work in all conditions. The quality of the stalks depends on the amount of rain, dew, and fog during the *drying phase*; the amount of time between the time the crop is ready to cut and is actually cut; and whether the crop dried down naturally or froze. The initial settings in Appendix 3 are a starting point and not a final setting.

Color of the combine

Any color combine will work in sesame

Any well maintained combine can harvest sesame when setup properly no matter its color or threshing mechanism, whether conventional or rotary. In terms of a quality harvest, the operator is more important than the combine. In 2007 sesame was successfully harvest with a relatively new combine and equally as well with a combine more than 25 years old. Newer model machines are easier or more quickly adjusted to changing conditions to cover more acres with larger headers and capacities. All combines, new or old,

should be inspected for sesame leaks and sealed appropriately.

Header

Starting at the cutter bar, header height is set according to the lowest capsules expected to be harvested. In most cases this will be 1 to1 ½ ft from the ground. Rarely will the header touch the ground on well grown sesame. Insure proper header height by looking out the side cab window to see that no capsules are left on the lower plant stems.

The most common header used in sesame is the conventional platform header. Auger headers allow the sesame to stand up as it moves across the header and is then pulled in at the center.

Large draper headers appear to be very good at harvesting sesame, but the drapers used can result in the center belt throwing sesame back out the front of the header. The solution to this problem is to keep the center of the header always loaded and cutting sesame. A circular harvesting pattern can minimize loss by keeping plants flowing over the center belt.

The most common header is a platform header

Operators that intend on harvesting many acres of sesame, or those that harvest fields with large plants and high yielding sesame, attach a screen to the back of the header to retain sesame from going over the header. You can monitor the amount of loss from the header in this manner by noting the build up of sesame on the feeder housing without a screen. Header screens have been developed from almost any framing material, while using three foot nylon window screening from a hardware store. If trash builds up on the screen, it can be easily removed by thumping the screen with your hand, a broom, or compressed air gun.

The reel needs to have minimum effect on the sesame. Hume or pickup reels knock off too many capsules. A bat reel should be adjusted to the most extended height up and pulled as far back into the header as can be accomplished. The idea is to lightly touch the top 6 inches of the plants, feeding them into the header if need be. More likely, the reel needs to be set to not touch the sesame plant until the header is under the plant to prevent loss of sesame in front of the header. The reel speed should match ground speed to gently lay the sesame into the header.

Threshing

Cylinder and rotor speeds are set low to be gentle on the crop (350-400 rpm). Concaves are set equal to corn or beans (½"-1"). As sesame enters the cylinder or rotor, the abrupt change in direction does a majority of the threshing. The immediate direction change force cracks the capsule, releasing the seed. The open concave prevents the sesame from being scuffed or broken. The slow RPM allows the seed to be gently dumped from the capsule.

To simulate the goal of threshing sesame, take a dry sesame capsule, invert it, and twist it between your thumb and forefinger while applying gentle pressure equal to snapping a peanut shell. When the capsule snaps or cracks, all of the sesame will be released without grinding the capsules. First time growers are amazed to see whole capsules exiting the combine without any seed in them. Another goal is to be gentle enough that some of the capsules are not even removed from the plant stems.

Seed Separation

Cleaning is a delicate process of balancing air force and sieve openings. On conventional machines with a pre-cleaner, the pre-cleaner should be closed. The chaffer is opened to about 1/4 - 3/8 inch, and the sieve is open to 1/8 inch. Many would think that such small seed would require the sieves to be closed. Closed sieves and chaffers reduce airflow. Reduced airflow allows the capsules and plant parts to ride on the sieves with the sesame seed riding on top of them. There needs to be adequate air turbulence to keep the plant material floating above sieves allowing the sesame to fall through and not ride out the back. Start with having your air set from medium force air and watch to avoid seed in the tailings. Sesame in the tailings will be scuffed or broken.

The best way to gauge if the seed is being blown out the back is to look at the tailings at the end of the field as the combine turns. Within the field, it is difficult to differentiate between what the wind blew out before the harvest, what the header shook out, or what came out the back. Another way is to take a large oil draining pan and toss it under the combine as it passes by.

Sesame Residue Management

Variable speed spreaders are preferred over choppers because choppers disintegrate sesame residue. Larger plant parts are preferred on the surface. Sesame residue has never interfered with good planting as long as it was spread properly.

Empty bin when seed reaches auger

The combine bin should be emptied when the seed reaches the bin auger. The sesame is 50% oil and the constant churning of the seed pushing up the bin level will damage the seed and lead to price discounts.

Fires

Under some conditions, the trash on the back of the combine will begin to smoke. Of particular concern are places where dust can collect near a hot surface such as a bearing, on the transmission, or near the exhaust where sparks may fly out. Fortunately, it is easy to smell the smoke. When there is a smoke odor, attend to it right away. Most operators just brush it off, but it is easier to just carry a spray bottle (old Windex bottle) filled with water. **Caution: do not use a blow gun to blow the smoldering trash into the combine where it can light other plant parts and plant parts in corners and crevices on fire.**

ROTATIONAL CROP BENEFITS AFTER SESAME

Water Use

One of the largest reasons for sesame to be expanding acres in Oklahoma is the benefit that sesame provides for protecting September rains for planting double crops in the fall. Beginning in the late *reproductive phase* and continuing through the *ripening phase*, sesame self-defoliates and gets rid of most of its transpiration surfaces. Unlike sorghum that is a perennial and continues to pull moisture from the soil until a freeze, during the last 30 days of drydown of sesame, soil water use is minimal. The plant has naturally gone into drydown and transpiration is minimal. Rainfall that occurs traditionally in September is stored moisture for the fall planted, cool season crops, when planting directly behind the combine.

Effects on Cotton Root Rot

Farmers in Arizona and Texas have reported that cotton following sesame has significantly less cotton root rot (*Phymatotrichopsis omnivora*) the following year.

Effects on Nematodes

Researchers at Texas A&M and Auburn University have found that sesame reduces root-knot nematode populations that attack peanuts and cotton.

Sesame has a deep tap root, which produces a natural biocide that suppresses most nematodes. Growers have noted a suppression of nematode populations in rotational crops such as cotton, peanuts and other crops. Research shows that sesame may be an effective rotation crop to control peanut root knot nematode (*Meloidogyne arenaria*) and southern root knot nematode (*M. incognita*). Sesame rotation is not effective, however, for the Javanese root knot nematode (*M. javanica*). (Starr and Black, 1995). [1]

Farmers in Alabama have added sesame into rotation with cotton, peanuts, and soybeans. Nematode levels are reduced and yields significantly increased among those crops in fields previously planted in sesame. (Anon, 1997)[2]

Soil Improvements After Sesame

- Sesame is an excellent soil builder. Roots have as much mass as the visible plant. Stalks disc into soil easily and break down quickly. Soil is very mellow and requires little work for next crop. Many farmers have done one light disking and planted wheat. Tilth and moisture retention is improved.
- Farmers walking across split planted fields can feel under their boots how much more mellow the ground is after sesame.
- Farmers ripping diagonally across fields with cotton, sesame, and sorghum, have been able to operate one gear higher on the sesame ground.
- Farmers listing across pivots have to raise the lister when on sesame ground.
- In high erosion areas, ground after sesame does not blow as much as many crops. However, sesame does not have enough residues to qualify as a high residue crop.
- Farmers report that after sesame, the soil retains moisture better for planting the next crop.

[1] Starr, J. L. and M. C. Black. 1995. Reproduction of *Meloidogyne arenaria*, *M. incognita*, and *M. javanica* on sesame. Suppl. J. Nematology 27(4S):624-627.

[2] Anon. 1997. Sesame rotation controls nematodes and provides Alabama a new cash crop. Highlights of Agricultural Research. Vol. 44, No. 1, Spring 1997.

- In dry years after sesame, in split planted fields, corn and cotton do not show as much stress after sesame. The soil retains moisture better.

Cotton After Sesame

Many farmers have incorporated sesame into their cotton rotation because it increases yield; suppresses populations of root knot nematodes; is not susceptible to cotton root rot; and extends limited water so that they can concentrate their water for cotton.

With early warm weather or delayed planting date, sesame can volunteer in cotton. Farmers easily control sesame in Roundup Ready and Liberty Link cotton. Sesame is extremely susceptible to glyphosate and glufosinate. In most years, the sesame will not come through prometryn (Caparol). If sesame survives in the cotton, the cotton grade has never been affected and volunteers have rarely bothered pickers or strippers.

Sesame and cotton are good rotations

Peanuts After Sesame

Many farmers have incorporated sesame into their peanut rotation because it increases yield; suppresses populations of root knot nematodes; and extends limited water so that farmer can concentrate water for peanuts. Sesame can volunteer in peanuts. Imazapic (Cadre) and 2-4D provide effective control. Some farmers prefer a wiper with glyphosate.

Wheat After Sesame

Many farmers have incorporated sesame into their wheat rotation because it increases yield and provides a second cash crop.

Sesame ahead of wheat will use resources - moisture and fertility. In dryland conditions in a dry year, there may not be enough moisture for both crops. No additional total fertilizer is necessary for wheat, but wheat will need more up-front nitrogen (10-20 units/ac), since the breaking down of the sesame stalks will tie up a bit of the nitrogen early.

In Northern Oklahoma, sesame will push wheat planting into November or December and will not work for grazing wheat. In South Texas, planting rye for grazing after sesame has increased the number of days the cattle can stay on the field and has increased daily weight gain.

Alfalfa After Sesame

In Arizona, sesame is harvested before alfalfa is normally planted, allowing for a summer crop to cover the ground during the heat. No additional total fertilizer is necessary for alfalfa, but alfalfa will need more up-front, since the breaking down of the sesame stalks will tie up a bit of the nitrogen early.

HOG AND DEER TOLERANT

Deer do not like green sesame. The only time there will be deer damage is when there is no other food. Deer set up trails in the sesame on their way to corn and sorghum fields which can be devastated.

Wild hogs may bed down in sesame but do not eat the sesame. The only damage is in the bedding area and the trails to water and food.

OTHER CONSIDERATIONS

Sheep, horses, and cattle do not like green sesame, but goats will eat it. Sheep, horses, and cattle have been turned into weedy sesame fields and they will do a good job cleaning weeds from the sesame.

There has not been any significant damage from birds. Blackbirds from nearby sorghum fields may stop in the sesame and break over a few tops but will not eat the sesame. Doves normally eat fallen sesame.

Sesame provides good food plots for doves, quail, and pheasants. Flocks of doves have stayed around sesame nurseries well into March in Oklahoma.

APPENDIX 1. SESACO VARIETY CHARACTERISTICS

There are 5 varieties available for 2008:

- S25 (US patent 6,815,576)
- S26 (US patent 6,781,031)
- S28 (US patent 7,148,403)
- S29 (US patent 7,332,652)
- S32 (Patent pending) **NEW for 2008**

All 5 varieties are covered by US patent 6,100,452 – Method for making non-dehiscent sesame. S32 is also covered by Method for making improved non-dehiscent sesame (Patent pending).

VARIETY RECOMMENDATIONS

Sesaco 25 (S25) is an early variety that has done well on the Caprock and Oklahoma since 2002. It does not have as much drought resistance as S26/S28 and thus, has not been used much in the Rolling Plains. In cooler nights, S25 continues flowering and producing capsules while the other 4 varieties stop. It has been the main variety planted in Oklahoma. The variety may go to regrowth which delays harvest.

Sesaco 26 (S26) has been the main variety for high heat areas of southern Oklahoma, Texas Rolling Plains and south Texas since 2003. It has proven to be very drought tolerant and is the best variety against the silverleaf whitefly. S26 is the best line in low populations, as the branches make up for the spaces.

Sesaco 28 (S28) was selected to be an earlier variety than S26. It has been planted primarily in irrigated fields. S28 is like S26 in it is good in low populations, as the branches make up for the spaces.

Sesaco 29 (S29) was selected to replace S25 on the Caprock and Oklahoma. Side by side, the varieties are comparable, with a slight edge to S25. There has been little testing with S29 in Oklahoma. S29 is better on lodging resistance on all lines. The variety may go to regrowth, which delays harvest, but not as much as the S25.

Sesaco 32 (S32) was planted on 11 farmer fields (In TX in Monte Alto, Batesville, Knippa, San Angelo, Rule, Seymour, Vernon, Lorenzo, Littlefield, and Amherst; in OK in Enid) and side by side, appeared to be better than the existing varieties. S32 is considered an improved non-dehiscent variety because it holds the seed better for the combine. 2007 was a higher than normal rainfall year, and more testing will be done in 2008.

Based on the amount of experience with a variety and the data below, the following recommendations are made for each area.

Lower Rio Grande Valley: Only S26. This is an area that has high populations of whitefly every year. To avoid the whitefly, the sesame should be planted preferably in late March or early April for a Spring crop and in mid August for a Fall crop. Any testing with S32 should be done in a small research plot.

Wintergarden area: S26 has proven to be a very good variety in dry and wet years. S28 is the traditional variety in Knippa with little testing elsewhere. S32 looked very good in irrigation and needs to be tested in dryland.

Rolling Plains from San Angelo TX through Altus OK: S26 has proven to be a very good variety in dry and wet years. There has been little S28 planted but in side by side fields in 2007, S28 was better. S32 looks promising.

Caprock: S25 and S29 have proven to be good varieties. S26 and S28 have proven to not be as well adapted to this environment. S32 looks promising.

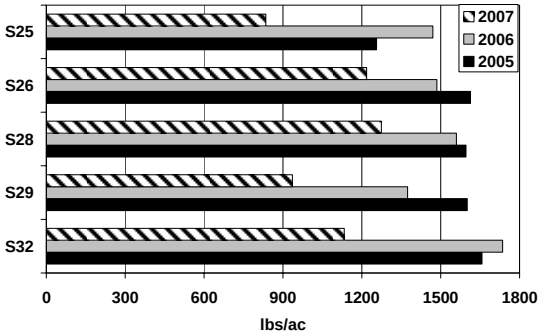
Oklahoma: S25 and S29 have proven to be good varieties. S32 looks promising.

VARIETY CHARACTERISTICS

In normal populations, all varieties have branching. S25 and S29 have fewer branches than S26, S28, and S32. The amount of branching is dependent on the row spacing and population. Wider row spacing and lower plants per foot lead to more branching. All varieties have a single capsule per leaf axil. All varieties have buff seed color suitable to US markets.

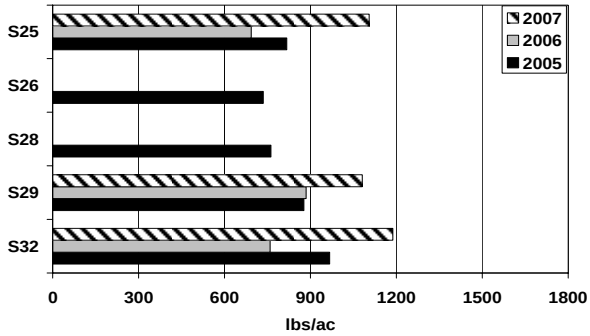
SESACO RESEARCH YIELD[1] (lbs/ac) WHEN THE PLANTS READY FOR COMBINING

UVALDE, TX - irrigated



- The Uvalde nurseries are planted on 30" rows in late May and are furrow irrigated with 30 units of N preplant and 30 units side-dressed 3-4 weeks after planting.
- In 2007, there were 42" of rain between planting and ripening. The plants were very yellow and sick for most of the vegetative and reproductive phases.
- In 2006, there were 0" of rain between planting and ripening.
- 2005 was a normal year with about 4" of rain.

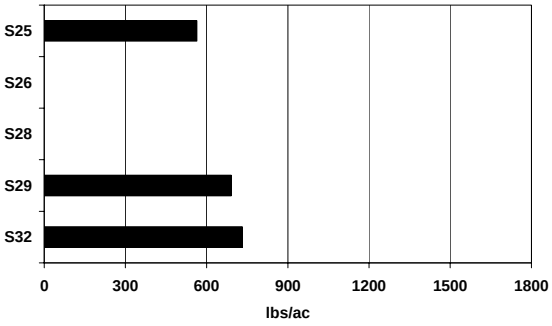
LORENZO, TX - dryland



- The Caprock (Lorenzo, TX) nurseries are planted on 40" rows in mid June with 30 units of N preplant.
- Although there were no irrigations during the season, the 2005 and 2006 nurseries had a pre-irrigation in order to have planting moisture.
- In 2005 and 2007, there were about 3" of rain and in 2006, less than 1".
- In 2004 and 2005, S26 and S28 proved to be unsuitable for the Caprock and are no longer tested in this environment.

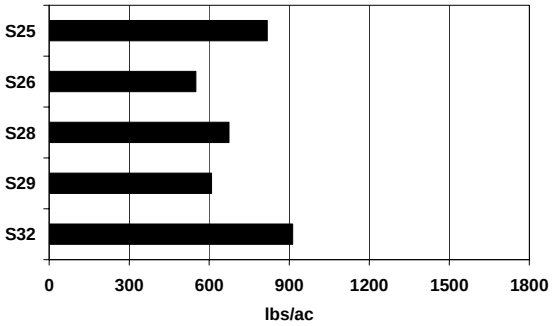
OTHER RESEARCH YIELD (lbs/ac) HARVESTED BY PLOT COMBINES

HUTCHINSON, KS - dryland



The yields were taken in Kansas State University plots in Hutchinson, KS, in 2007, planted on 7.5" rows on Jun 22. There was little precipitation during the growing period.

COLUMBIA, MO - dryland



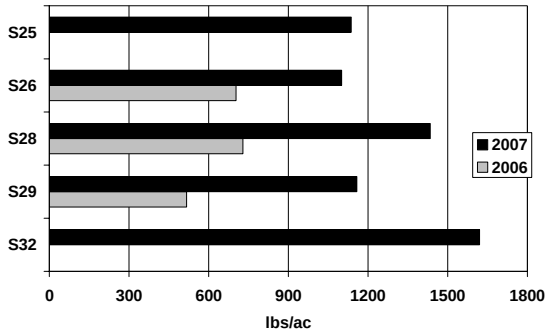
The yields were taken in Jefferson Institute plots in Columbia, MO, in 2006, planted on 30" beds in early June. There was little precipitation during the growing period.

[1] These yields are taken in research nurseries and should only be used as an indication of potential and for comparison between varieties. The yields are replicated extrapolations from cutting 10 ft of sesame in a representative part of the field. The yields change under different planting dates, weather patterns, moisture/fertility, and farmer practices.

YIELD IN FARMER FIELDS[1] (lbs/ac) WHEN THE PLANTS READY FOR COMBINING

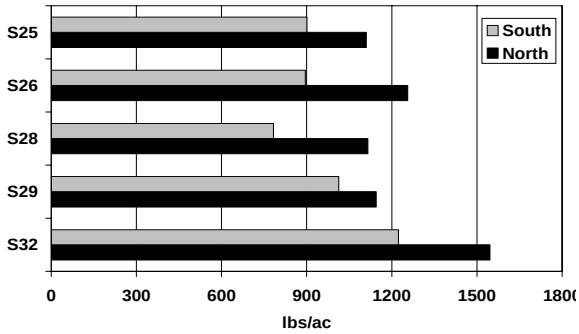
These yields are taken in farmer fields planted with farmer equipment and should only be used as an indication of potential and for comparison between varieties. The yields are replicated extrapolations from cutting 10 ft of sesame in a representative part of the field with a uniform stand. The samples were not taken from the best or the worst parts of the field, and each variety was tested side-by-side with the other varieties. The yields change under different planting dates, weather patterns, moisture/fertility, and farmer practices.

WALL, TX – semi-irrigated



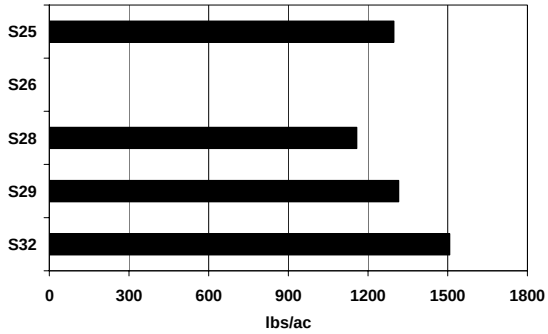
The yields were taken in Billy Schwartz' fields in Wall, TX in 2006 and 2007, planted on 40" beds in mid June. 2006 was dryland in a dry year, while 2007 was irrigated, but only one irrigation was necessary because of above normal rainfall.

RULE, TX - dryland



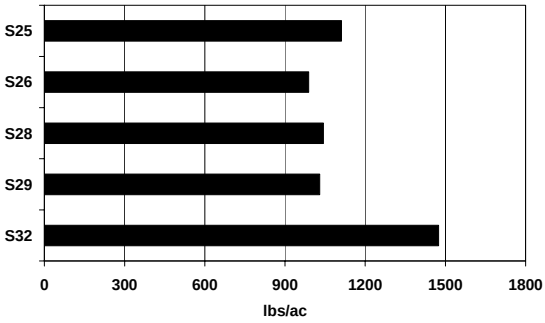
The yields were taken in Lynn Dale Dudensing's dryland field in Rule, TX in 2007, planted on 32" beds in late June. The strips were one mile long and samples were taken at the north and south ends of the field.

VERNON, TX - dryland



The yields were taken in Darren Streit's dryland field in Vernon, TX in 2007, planted on 40" beds in late June.

AVERAGE OF ALL FARMER FIELDS



This graph is an average of all of the yields in this appendix planted in farmer fields using standard farming equipment. The average covers from 30" to 40" beds, from dryland to semi-irrigated, from early to late planting, from South Texas to North Texas.

OTHER DATA

All the data that follows was taken from Sesaco research nurseries. The nurseries were planted mid way between the earliest and latest possible planting date. When planting later, the cycle becomes more important than the yield. In South Texas, the fall days are shorter and cooler leading to poorer harvest weather. On the Caprock and northern

[1] As with all other crops, research yield sampling results often exceed combined yields.

Oklahoma, there is a danger of an early frost. In planting later in all areas, it is important to plant the lines that are ready for harvest in the shortest amount of time to minimize risk.

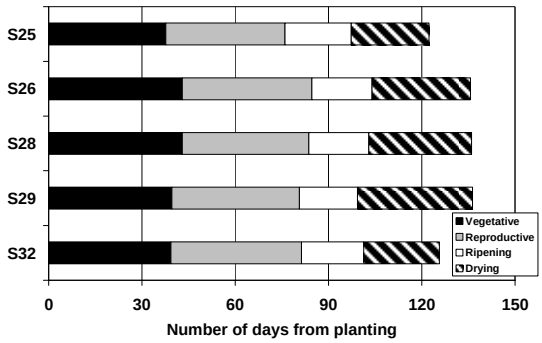
The following graphs show the average cycles from 2005 through 2007.

- The vegetative phase runs from planting until 50% of the plants have white open flowers.
- The reproductive phase ends when 90% of the plants do not have white open flowers.
- The ripening phase ends when the plants reach physiological maturity.
- The drying phase ends when the plants are ready for combining.

The graphs reflect the averages with variation between years, depending on the amount of moisture/fertility and the weather during drying. Fields with more moisture and fertility will flower longer and produce higher yield. Fields with dry conditions, coupled with low humidity and wind, will dry down faster.

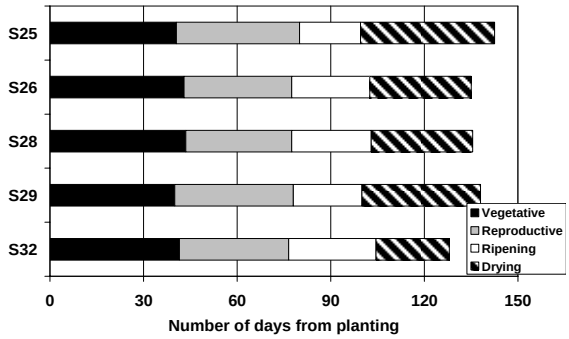
AVERAGE CYCLES 2005-07 (days from planting)

UVALDE, TX



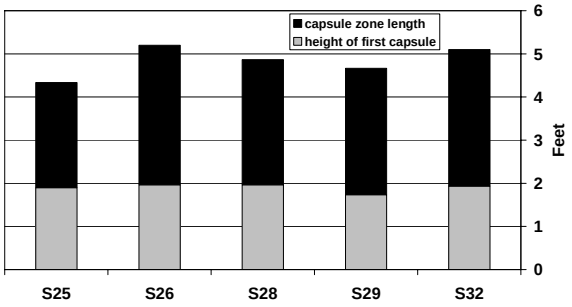
In Uvalde, the S25 is ready to combine first, but it is not suitable for the area. Although the rest of the lines have 75% ripe capsules at about the same time, the S32 dries down faster.

LORENZO, TX



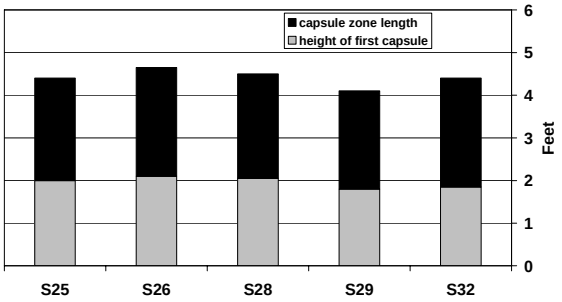
On the Caprock, S25 flowers and takes longer to dry down than the other varieties. The fastest to dry down is S32 allowing for earlier harvest.

UVALDE PLANT HEIGHT (ft)



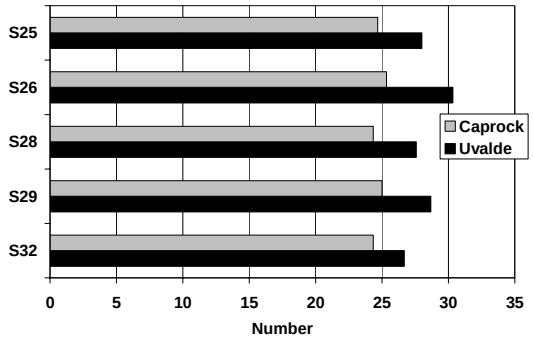
In Uvalde under irrigation, some of the heights reach the upper limit of being able to be combined with a platform header. Under dryland conditions in Uvalde, the heights are closer to the graph to the right.

LORENZO PLANT HEIGHT (ft)



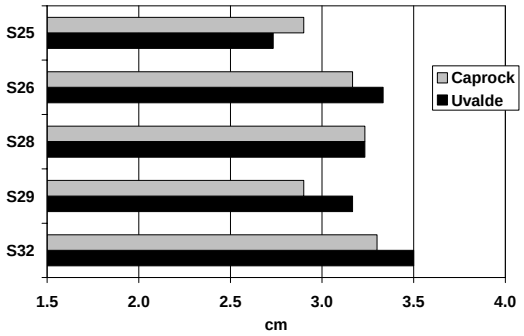
On the Caprock in dryland, the heights are all good for combining. Note that the height of the first capsule does not change appreciably, meaning that there is a smaller capsule zone.

NUMBER OF NODES ON MAIN STEM



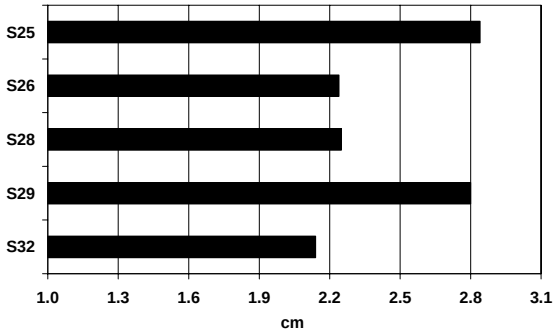
The number of capsule node pairs is generally lower in dryland than in irrigated.

INTERNODE LENGTH (cm)



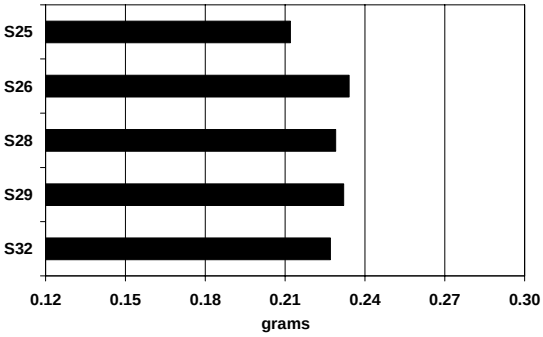
The internode length is generally lower in dryland than in irrigated, with the exception of S25.

CAPSULE LENGTH (cm)



The capsule length is very visible and some feel that the longer the capsule, the higher the yield. See the chart to the right.

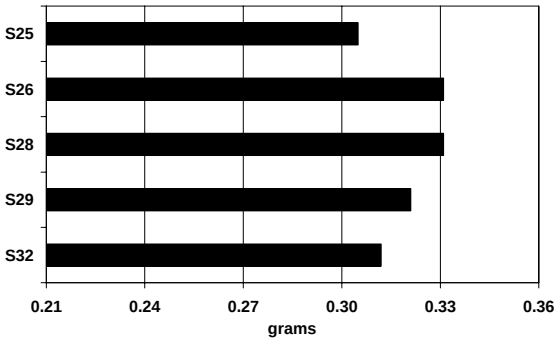
SEED WEIGHT PER CAPSULE (g)



The seed weight per capsule is more important than the capsule length to the left.

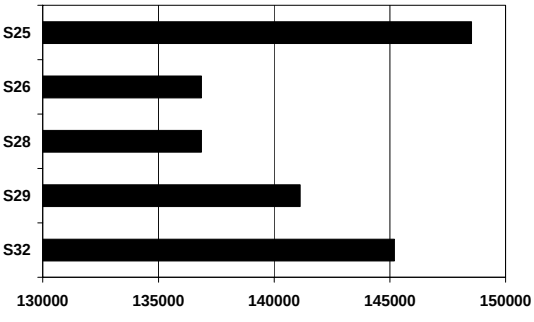
The seed size is very important in setting the planter, particularly with air planters. When changing varieties, it is important to reset the gearing.

100 SEED WEIGHT (g)



The goal for the US market is >0.30 with larger seed being better.

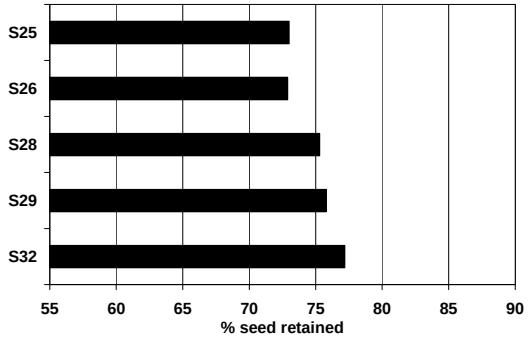
NUMBER OF SEEDS PER LB



The smaller the seed, the higher the number of seeds in 1 pound.

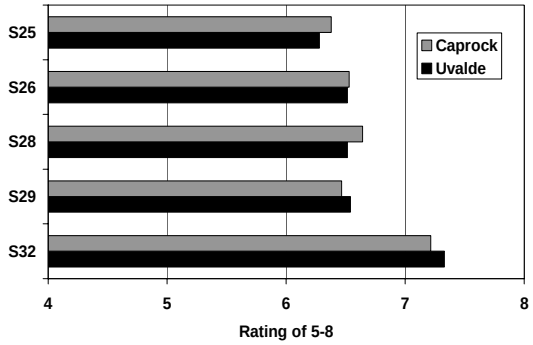
The following two ratings indicate the relative amount of shatter resistance.

SHAKER SHATTER RESISTANCE (%)



The shaker shatter resistance comes from subjecting 10 capsules to shaking for 10 minutes. This approximates the amount of seed that will be retained by the capsules 3 months after the plants are dry enough for combining. The goal is >65. All varieties grown in TX, OK, and KS, in the 1990s had ratings of 34 to 62%.

IMPROVED ND RATING (5-8)

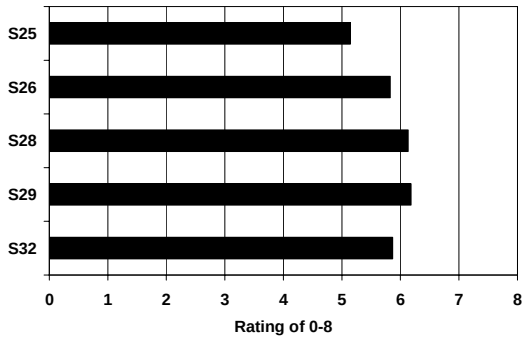


The improved non-dehiscence rating is given only to lines that have enough visual shatter resistance for combine harvest. It is taken 4 weeks after the plants are dry enough for combining. The goal is >7.

COMPOSITE KILL RATINGS 2005-07 (0-8 rating – goal > 6)

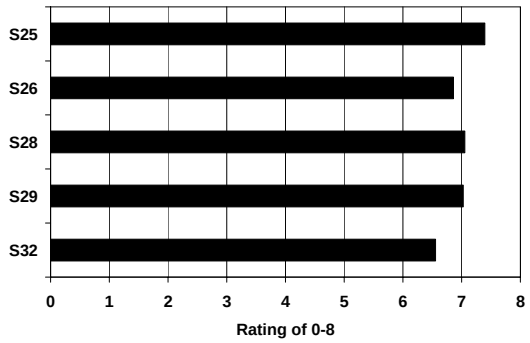
There are three root rots that affect sesame: *Fusarium oxysporum*, *Phytophtora parasitica*, and *Macrophomina phaseolina*. Of the 3, *Fusarium* is the most destructive because it can strike earlier in the cycle and kill the plants. *Macrophomina* shows up only when moving from good moisture to a drought.

UVALDE, TX



In Uvalde, the nurseries have been planted in the same area since 1988, and there are more accumulated spores than anywhere else in the growing area. This area is used to screen for tolerance to root rots.

LORENZO, TX



On the Caprock, the nurseries have been planted on new fields each year and are more representative of what would be expected in most areas.

VARIETY RAW DATA

Character	Year/nursery[1]	S25	S26	S28	S29	S32
Branching Style	All	Few	Many	Many	Few	Many
Number of Capsules per Leaf Axil	All	1	1	1	1	1
Seed Color	All	Buff	Buff	Buff	Buff	Buff
Yield (lbs/ac)[2]	2005 UV	1256	1613	1596	1601	1657
	2006 UV	1470	1485	1560	1374	1735
	2007 UV	835	1218	1274	936	1133
	2005 CP	817	735	762	877	967
	2006 CP	693			885	759
	2007 CP	1105			1081	1188
Days to Flowering	2005-07 UV	38	43	43	40	39
	2005-07 CP	41	43	44	40	42
Days to Flower Termination	2005-07 UV	76	84	84	81	81
	2005-07 CP	80	78	78	78	77
Days to Physiological Maturity	2005-07 UV	98	104	103	99	101
	2005-07 CP	100	103	102	100	105
Days to Direct Harvest	2005-07 UV	121	137	137	137	126
	2005-07 CP	142	135	135	138	129
Height of Plant (ft)	2005-07 UV	4.3	5.2	4.9	4.7	5.1
	2005-07 CP	4.4	4.7	4.5	4.1	4.4
Height of First Capsule (ft)	2005-07 UV	1.9	2.0	2.0	1.7	1.9
	2005-07 CP	2.0	2.1	2.1	1.8	1.9
Number of Capsule Nodes	2005-07 UV	28.0	30.3	27.6	28.7	26.7
	2005-07 CP	24.7	25.3	24.3	25.0	24.3
Average Internode Length within Capsule Zone (in)	2005-07 UV	2.7	3.3	3.2	3.2	3.5
	2005-07 CP	2.9	3.2	3.2	2.9	3.3
Capsule Length (in)	2001-2006 All	1.12	0.88	0.89	1.10	0.84
Seed Weight per Capsule (g)	2001-2006 All	0.212	0.234	0.229	0.232	0.227
Shaker Shatter Resistance (%)	2001-2006 All	73.0	72.9	75.3	75.8	77.2
Improved ND rating	2005-07 All	6.34	6.52	6.59	6.50	7.25
Seed Weight – 100 Seeds (g)	2001-2006 All	0.305	0.331	0.321	0.306	0.313
Seeds per pound	2001-2006 All	145,525	136,858	136,858	141,121	145,192
Composite kill rating	2005-07 UV	5.15	5.83	6.13	6.18	5.87
	2005-07 CP	7.40	6.86	7.06	7.03	6.56

[1] Data is from two nurseries: UV = Uvalde TX and CP = Caprock in Lorenzo TX

[2] These yields are taken in research nurseries and should only be used as an indication of potential. The yields are replicated extrapolations from cutting 10 ft of sesame in a representative part of the field. The yields change under different planting dates, weather patterns, moisture/fertility, and farmer practices.

APPENDIX 2. PLANTING EQUIPMENT

If you don't find your planter mentioned here, give SESACO a call in advance, and they will be happy to assist you in making recommendations for setting up your equipment.

Does not work:

It is easier to list the things tried that have not worked in comparison to the number of things that have worked in planting sesame.

- Kinze brush meters do not work because seed will build up in the brushes and flow past the plate.
- Double run drills often crush the seed.
- Broadcasting the seed and working it in with a Brillion planter has been tried a dozen times or more and has never worked!

Does work:

A 3 lbs/ac setting for low rate sorghum plates is usually close to 3 lbs/ac for sesame. In some planters, tomato and sugar beet plates work.

Vacuum Planters

John Deere Maximerge Type Setup:

- JD part # 45 cell A43066 "Small milo disc" or 45 cell H136445 "Raw sugar beet disc". Both do a good job.
- "Knocker Assembly" #AH129125 is installed with each plate.

  Using the low range input socket initial settings, use 24 or 29 for 2.5 to 3 lbs/ac on 30" rows, or 20 or 24 for 2.0 to 2.5 lbs/ac. Tighten the disc so it is snug but turns freely against seed meter housing. The plate should make about one half of a turn after released from giving a good spin. Be sure the rubber gasket and brush are in good condition. There is usually a small amount of leakage even when running low vacuum (4").

Monosem NG Plus Planter Setup:

- DC144-08 Plate
- Light vacuum setting

When selecting a Monosem plate, check to get as many cells on the plate as possible, even higher than 144 if possible. Because a Monosem can actually singulate sesame seed, the plate must turn at extremely fast speeds when having a lower cell count to the plate. A 72 cell plate restricts planter traveling speeds to below 2.5 mph. At high plate speeds, sesame are cut in half by the brass seed scraper and sucked into the cell causing cell blockage by the vacuum. There is no mechanism to remove the blockage and soon all cells can be blocked.

CNH AMS 1200

To date, a CNH AMS 1200 vacuum planter has not been used to plant sesame. Talk to your equipment dealer for ordering custom made plates at least 45 days ahead of your intended planting date. One West Texas farmer has modified his meter housing to contain the "JD Knocker Assembly" #AH129125 for use with other small seed crops.

New Kinze –EdgeVac

To date, the new Kinze vacuum planter has not been used to plant sesame. Contact your equipment dealer and SESACO representative early to investigate a suggested setup.

Air Planters

IH Drum Planting system

- IHC part # 1546936C1 "Small seed drum".
- Must carefully shrink vent holes by hammer blows.
- There have been mixed results because it is difficult to plant enough seed and requires a slow planting speed (2 MPH works best).

White

In 2007, a White planter was successfully used. The grower used a die cast grinder with thin grinding wheel to make notches in a blank seed plate. The plate contained 45 notches equal to the number cells in a JD vacuum plate.

Plate Planters

Accurate 2 piece plastic plate sets for IHC and John Deere planters can be ordered from:

Lincoln Ag- Products Company, Lincoln, Nebraska, at (402) 464- 6367, lincolnagproducts.com.

These compensate for false bottom wear and provide good seed control.

John Deere 71 flex, 50, 60, 80, 6100, plate style Max-emerge, and other older JD plate style planters: Lincoln Ag Products part # B-Sorg 00-30 Plate, BFR-1 Ring.

International 186, 386, and older units: Lincoln Ag Products part # C-Sorg 00-30 Plate, CFR-1 Ring.

A red "Star Knocker" #CSK-1 helps these plates avoid seed damage.

Hints to control leakage and grinding seed:

- A piece of duct tape over the sprung cutoffs riding the plate will stop leakage there. Replace cutoff if worn or grooved excessively.
- A hollow 1" roll of duct tape, sticky side out, 3 or 4 places on your steel false bottom "springs" the plastic plate set upwards, stopping leakage over the plate. Test plate rotation - clear any binding.
- Some farmers have used weather striping instead of duct tape.

Cup or Bowl Meters

John Deere 80: "Low rate sorghum attachment", JD part # B31298 Feed Cup Spacer, B31205 32 Cell Feed Cup, B31300 Thrust Washer.

John Deere bowl style dispenser Max-emerge: JD part # A25081 Shim, A36323 Plate, and AA25319 bowl set.

If you have to grind off 2 of the drive 'dogs' of the JD plates, do not grind any deeper than necessary.

Drill planting equipment

In General

Again, narrow drill spacing (below 15") has not worked reliably and only resulted in higher planting seed rates and cost. Many drills can be set with various configurations. The most common is covering every other meter of a 7.5" drill to make 15" rows. 6" drills cover two out of three meters to make 18" rows. In 2007, a 10" drill was configured with two meters open and two meters closed. This made a 30" middle that allowed the grower to cultivate once and spray a harvest aid by ground. Another spacing that will be tried in 2008 is to cover every third row of a 7.5" drill.

Box Drills

Drills must have the ability to meter seeding rates to 25-35 seeds per foot without grinding seed. Check metering cups for proper placement to have equal openings. Use the narrowest one to calibrate.

A starting point for the proper settings is to use the flax setting and compare to the pounds of sesame desired. Remember if you are covering meters to get wider row spacing, divide by the percentage of openers remaining open.

- Example 1: A 7.5" drill with every other meter covered to achieve 15" spacing equals 50% open meters. 5lbs/ac ÷ 0.50 = 10lbs/ac. Start calibrating with the flax setting at 10lbs/ac.
- Example 2: A 6" drill with two of three meters covered to achieve 18" spacing equals 33% open meters. 5lbs/ac ÷ 0.33 = 15lbs/ac. Start calibrating with the flax setting at 15lbs/ac.

Air Drills

In 2007, two JD 1910 Commodity Air Carts were used to seed over 1,000 acres of sesame successfully. Use the fine seed meter (yellow and order from your dealer way in advance of the planting season). To calibrate the air cart, follow the operator's manual for standard calibration test. Conduct a stationary test to get with in range of the proper calibrated setting and then do an in field calibration of at least 2,000 ft to accurately set the planter.

Various setups with the air cart and drill can accomplish the same results. In this case, half of the meter is shut off and the over half is directed to only the front gang of a 1890 No-till Air Drill. It is easier to calibrate the drill with both halves of the meter open, and then divide the determined metering volume in half and close the gate to one half of the meter.

In 2007, a Great Plains No-till Air Drill was used to plant in 15" row spacing. A vented "Y" was used to connect air hoses at the planting unit. Be sure to consider half the initial setting compared to flax when seeding in this manner. If the desire rate is 4lbs/ac of sesame, the meter should be set on 2lbs/ac of flax.

Drill Seeding Units

JD 90 Series Openers are excellent for seeding a firm seedbed, but in softer soils, the cast iron closing wheel moves too much soil on top of the seed.

Double disc openers are great. There should be minimal compaction over the seed line.

Hoe drills can be used with modifications since they tend to mix dry dirt with the seed. By adding a 2" extension on each side of the tube, the dry dirt can be kept out until the seed falls on to the firm, moist seedbed.

APPENDIX 3. INITIAL COMBINE SETTINGS

General comments

Sesame is 50% oil and can be easily damaged releasing free fatty acids and turning the seed rancid. Combine settings should **be as slow and gentle as possible while still moving the crop through and the air as high as possible without blowing seed out the back**. Sesame uses slower cylinder speeds and wider opened concaves than comparable crops. There are often price discounts from broken seeds when combines come in to a sesame field from other crops without adjusting the settings.

Never open the concave all the way because plugs will take a long time to remove.

Sesame needs to be less than 6% moisture. As the sun sets, the seed will begin picking up moisture in humid areas, and the field will not be ready to combine again until later the next day.

Clean the combines before starting – wet or spoiled seed can ruin a truckload of sesame!!!! If it rains between cuttings, reclean the combine. Sesame is food grade. Even if it has not rained, dew can collect and go to the auger and start to spoil the sesame that the auger does not clean out.

Like other small seeds, sesame does not clean up in a combine as well as wheat, sorghum, or corn. Expect 5-10% deduction from the gross weight.

Initial combine settings

JD 95/96 series:
- Cylinder rpm: 400
- Concave: open to corn
- Air: 750
- Top sieve (wheat): barely open
- Combination sieve: completely closed
- Bottom sieve: completely closed

A JD9650 in 2007 had premiums with:
- Cylinder rpm: 400
- Concave setting at 33
- Air: 750
- Chaffer set at 10
- Sieve set at 0

IHC 1680:
- Cylinder rpm: 350
- Air: 450
- Fine grain concave (wires in)
- Skirts/blockers out
- Transport vanes – fast exit of crop
- Set for very easy thrash
- Good reports of avoiding fine trash problems by enclosing cage with ‘cage skirts’

AGCO R65:
- Cylinder 375
- Concave clearance: 1”
- Air set on 1
- Chaffer: 1/4 to 3/8 open
- Sieve: Closed
- Block internal air blast
- Disconnect cage “wiper”

Other conventional combines:
- Feeder housing chain adjusted fast and close
- Concave adjusted for ‘corn’
- Cylinder at slowest RPM
- Air at minimum - but not disconnected
- Top sieve open 3/8" (width of a pencil)
- Bottom sieve closed

Test cutting

- Ground speed needs to be fast enough to load the sieves.
  - 3-4 MPH in heavy crops (irrigated)
  - 4-7 MPH in light crops (dryland)
- Adjust ground speed to help bring the crop into the header.
- Bring concaves in towards ‘soy’ only enough to remove mature seed from capsules. No settings will remove 100% of the seeds from the capsules. There can be capsule deformities that will not allow the seed to flow out. There are 70 seeds per capsule; open 50 capsules without deformities and there are usually 0 to 10 seeds left in - 0 to 0.3%.
- Partial stalks with many capsules still attached are normally seen coming off the straw walkers.
- The cylinder speed is only increased if problems in feeding occur in the smaller machines.
- Increase the air until seed starts coming out the back and then lower just a bit.
- Recheck seed return to insure there is no seed.
- Like with other crops, cut a small sample and test for moisture.
- Check for broken seed – should be less than 1 seed in 50 broken. If more slow down cylinder and/or open concave.
- Empty combine bin before it reaches the auger. The auger will churn the seed and cause damage. Churning is a major cause of deductions in grades.
- At times, the sieves will not close because there is a sorghum or corn stalk caught in the sieve. Open sieves lead to trashier sesame and can lead to price discounts.

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