



Using Fresh and Frozen Semen in a Swine A.I. Program

Glenn Selk

Extension Animal Reproduction Specialist

Swine producers considering or currently using artificial insemination programs may use raw, liquid, or frozen semen. Following are some points to keep in mind when using the different forms of semen.

Raw Semen

Raw semen is often the choice of swine producers just getting started in artificial insemination. Acceptable conception rates and litter size can be achieved using raw semen. Some of the potential problems associated with freezing or storing semen can be avoided by using raw semen as soon as possible after collection. This also represents some of the limitations of raw semen: 1) the boar of choice must be present or in close proximity to the females to be bred, and 2) there must be several females in estrus at the time of collection to achieve optimal use of the semen sample. The average volume of semen per ejaculate will vary widely with individual boars. The range may be as much as 50 to 500 cc. Boars that ejaculate 500 cc will provide enough semen to breed six to eight females. Raw semen can be split to insemination doses of 80 to 100 ml (1 ml equals 1 cc).

If possible, evaluate each ejaculate to determine that it contains a high concentration of motile, viable sperm cells. (Photo 5). Normal semen will have a chalky, creamy appearance. This shows that sperm concentration is high. As concentration gets lower, the opaqueness diminishes. Look for gross abnormalities, such as blood in the semen, which is very toxic to sperm. Semen should appear smooth and creamy, not chunky. A microscope is not essential to make an A.I. program work, but it is useful to verify concentration and motility as well as to check for abnormal sperm. An expensive microscope is not necessary, but one that has two or three power settings ranging from 30 up to 1000X would be needed (Photo 9).

The handling of raw, extended, or frozen semen requires sanitary conditions. The thermos or plastic bottle should be very clean and dry before the semen is allowed in the vessel (Photo 2). The same principle applies to the inseminating pipette. Remember, pure water is very toxic to sperm cells and detergents left on the surface of the bottles also will cause reduced sperm numbers. Always be cautious to avoid cold shock or sudden drop in semen temperature. Using a thermos bottle (Photo 2) or plastic bottle with a one-inch-thick foam rubber insulation should greatly reduce damage due to cold shock. Allow the whole ejaculate to cool slowly to room temperature (i.e. 70° F) if the semen is not used immediately.

Raw, unextended semen should be inseminated as soon as possible, certainly within two to three hours. Remember that

Oklahoma Cooperative Extension Fact Sheets
are also available on our website at:
<http://osufacts.okstate.edu>

the average ejaculate contains enough sperm to inseminate at least six to eight females. The best rule to follow is to use the semen as soon as possible after collection. Two factors are considered in insemination: number of sperm and volume of fluid. It has been shown that a minimum of two billion live sperm in an adequate volume of fluid are required to obtain adequate conception rates. Since some sperm will be dead, more than two billion are needed for each insemination. Researchers have shown that 50 cc. fluid volume is close to the minimum, and it is recommended that 100 cc. total volume be inseminated to maximize conception rates.

Extended Liquid Semen

Nearly all of the above recommendations and precautions for raw semen must be applied to the semen that is going to be used for more females. "Extenders" can be mixed with the semen collected and increase both its storage time and the number of inseminations possible from a single ejaculate.

How much an ejaculate can be extended depends on the volume of the ejaculate collected, the number of females to be inseminated, and whether or not short-term storage will be used. If five females are to be inseminated with fresh semen, a total volume of 500 cc. of extended semen is needed. If the ejaculate contains 100 cc., then 400 cc. of extender is required to obtain the necessary 500 cc. for five females. If some semen is to be stored for future use, then a higher rate of extension would be used and microscopic verification of sperm concentration may be advisable. **Commercially available extenders can be used, and when properly handled, will allow good fertility as long as three to seven days after collection. Follow the label directions closely.**

Two formulas for semen extender are presented in Table 1. These extenders, available commercially, can be stored in dry form until needed. Both extenders can be stored frozen.

Skim milk may be used as a semen extender if the following steps are taken prior to mixing with semen:

- 1) Heat in a double boiler to a temperature of 190 - 195°F for eight to ten minutes. Be careful not to scorch the milk.
- 2) After cooling to room temperature, break one egg and add the egg yolk only (minus the membrane) to one quart of milk. Carefully mix for about two minutes so as not to raise a froth.
- 3) Equalize the temperature of the milk to that of the semen.
- 4) Add the extender to the semen by slowly pouring the milk down the side of the container. Semen extended with skim milk should be used immediately.

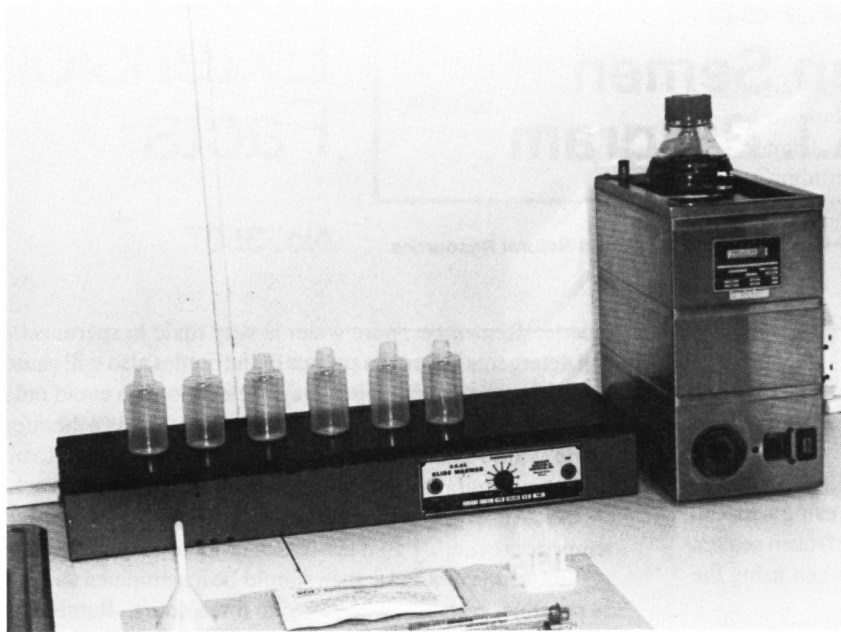


Photo 1. Prepare the equipment and warm the extender before bringing in the boar for collection.

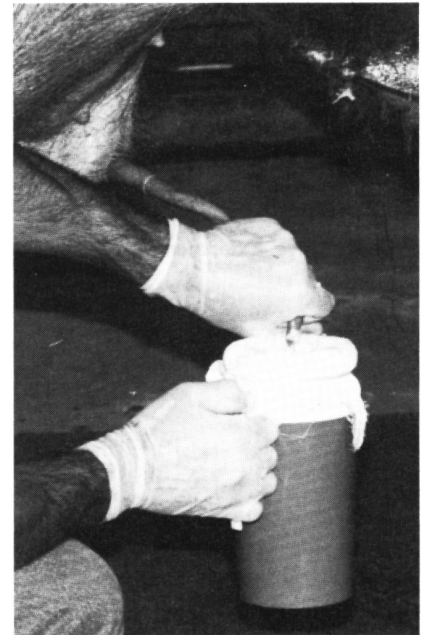


Photo 2. Collect the boar semen into a dry, plastic bag suspended inside a thermos bottle that has been covered with cheesecloth.

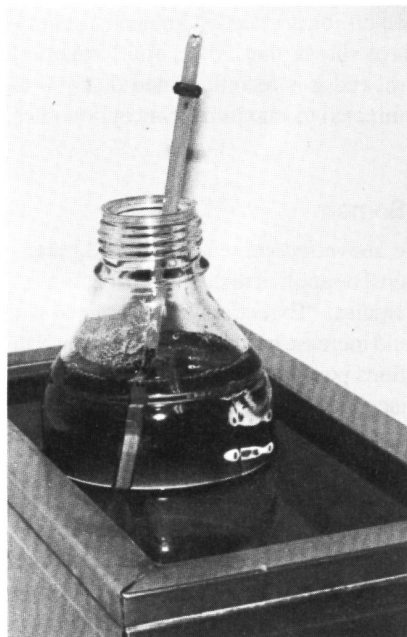


Photo 3. Make certain the extender has been warmed to the correct temperature. It must be within two degrees of the temperature of the semen.



Photo 4. Measure the temperature of the raw semen to be certain that the extender is the same temperature before mixing. This is necessary to avoid cold-shock.

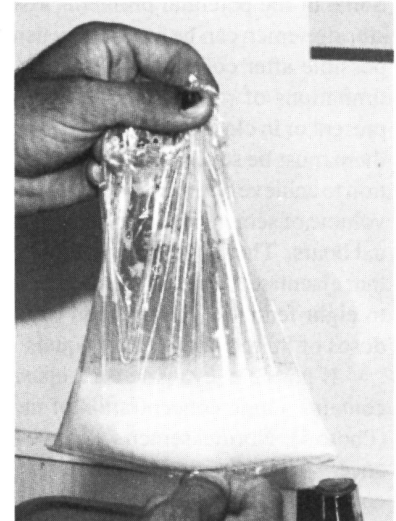


Photo 5. Observe the raw semen for gross abnormalities such as blood spots, mud, manure, or chunks. Normal semen will have chalky, creamy appearance.

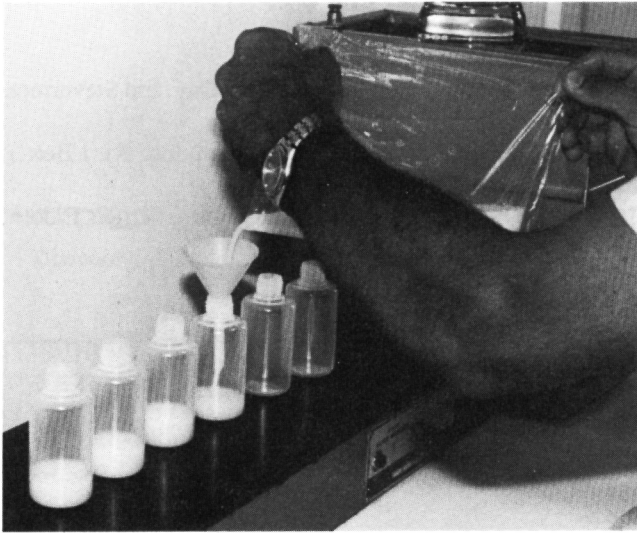


Photo 6. Gently pour the semen into dry, 100 ml disposable- plastic insemination bottles. Add until the bottles are one-fourth to one-third full. Less cold shock will occur if this is done on a slide-warming tray.

Photo 8. A drop of extended semen can be placed on a warm microscope slide for evaluation of the concentration, motility, and percentage normal cells.

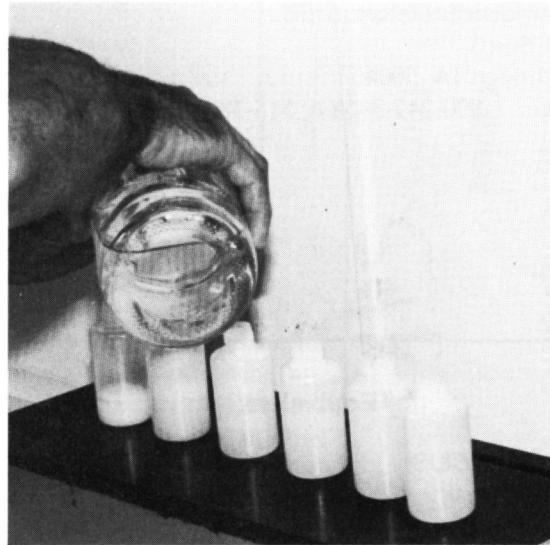


Photo 7. Gently add the extender to the semen to bring the volume of each bottle to 80 to 100 ml of total fluid.

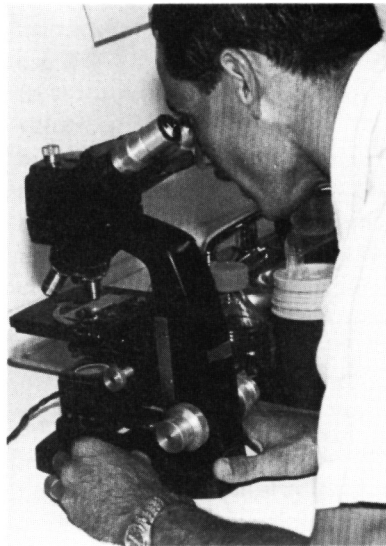


Photo 9. Microscopic evaluation for concentration, motility, and percent normal cells can help determine the viability of a particular boar's semen and the extent to which it can be extended in the future.



Photo 10. Extended semen should be placed in a covered Styrofoam box. This will eliminate damage from sunlight and reduce shock due to temperature change.

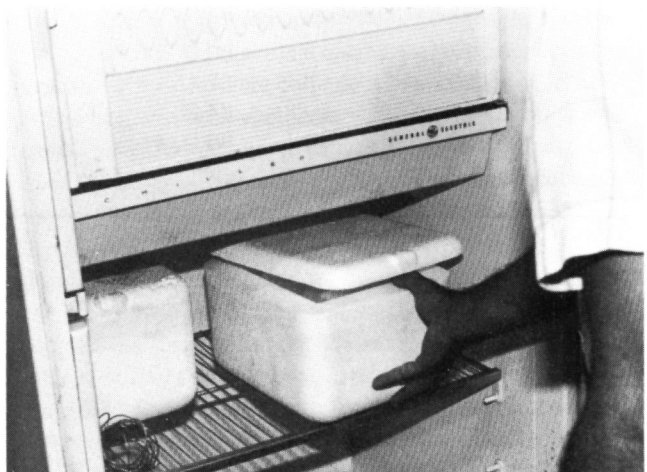


Photo 11. Store extended semen at 60 - 64° F. An altered refrigerator set to maintain this temperature can be used for this purpose; or commercially produced storage units can be purchased.

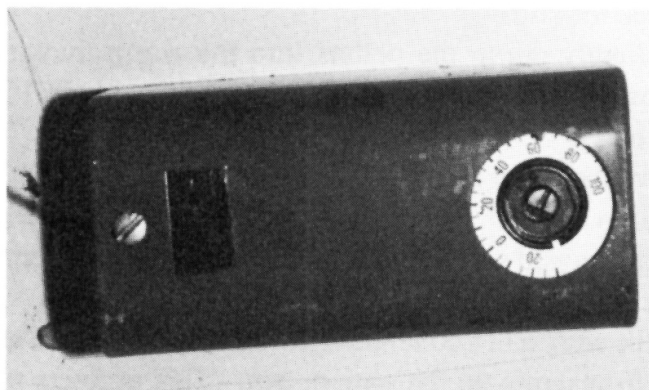


Photo 12. Maintaining storage at 60 – 64° F is important to maintaining semen viability.

Table 1. Extenders for use with liquid boar semen.

Component	BTS ^a (1 quart)	Kiev (1 quart)
Glucose	39.1 gm	63.4 gm
Potassium chloride	0.79gm	
Sodium bicarbonate	1.32gm	1.27gm
Sodium citrate	6.3 gm	3.96gm
EDTA	1.32gm	3.91 gm
Penicillin (million IU)	1.1	1.1
Dihydrostreptomycin	1.1 gm	1.1 gm
Distilled water	*	*

* Put ingredients in a clean beaker and fill to appropriate line with distilled water.

^a Beltsville Thawing Solution

Purchasing commercially prepared extenders and following label directions closely is often the method of choice. Usually, semen can be extended at the ratio of one part strained semen to three parts extender without any problem. Higher rates of extension are not likely to result in a decrease in conception unless a ratio of 1:10 or greater is used. It is always advisable to estimate sperm concentration and dilute the semen with an extender so that at least three to four billion sperm cells are used in any insemination. To maximize litter size and conception rate, investigators have shown that the use of two or more ejaculates pooled from different boars can be advantageous.

The process of extending the semen should be done as quickly as possible after collection from the boar. It will do no good at all to “extend” non-viable semen. Before extending the semen, measure the temperature of the ejaculate with a thermometer, and (Photos 3 and 4) raise or lower the temperature of the extender to within two degrees of the semen. Gently but thoroughly mix the two solutions (Photo 6). Violent shaking may result in damage to the sperm cells. The extended semen is now ready for insemination or storage. For storage, allow the mixture to cool to room temperature, 70-75°F. Place the container of semen in a small Styrofoam box (Photo 10) or in a pan of water (the same temperature of the semen), and put both in a refrigerator (Photo 11) that

is set to maintain a temperature of 60 – 64°F. Check the refrigerator ahead of time to be sure that this temperature can be maintained (Photo 12). These precautions are necessary to prevent the mixture from cooling too rapidly, thus causing damage to the sperm cells.

Commercially available fresh semen should be obtained from reputable companies. They are experts at handling and extending semen. Once the shipment is received, the responsibility is the owners to maintain the semen quality as high as possible until it is inseminated into the sows or gilts. Place order for semen several days before planning to use it. If breeding sows that are ready to wean pigs, plan to order of semen so that it will arrive about four days after weaning. Semen shipped at this time should remain viable throughout most of the post-weaning breeding period.

Store liquid boar semen at 60-64°F until inseminated.

Bottles of stored extended semen should be gently inverted daily so that sperm cells remained evenly distributed throughout the extender volume. As the various units of semen are being prepared for insemination, gentle mixing will be necessary because the sperm cells will tend to settle toward the bottom of the tube. Do **not** shake vigorously. If a microscope is available, check to be certain that the sperm cells are still showing a high percentage of motility, which will indicate that they have not been damaged during shipment or storage.

Frozen Semen

Commercial, frozen semen is available either in pellet form or in straws. Thawing of frozen semen in pellets or straws is done by eventually adding the semen to extenders. This is done to insure a large enough volume is being inseminated with the sperm cells.

Frozen Semen in Straws

Liquid semen arrives ready for use or temporary storage at 60-64°F. Frozen semen straws will be shipped in light weight liquid nitrogen tanks which have a short (usually seven days or less) holding time. The number of days semen can be stored safely in these units will be affixed to each container with a yellow caution sticker. Never allow the level of liquid nitrogen to get below four inches in either the shipping unit (when it contains semen) or in the personal on-farm storage tank. If the semen is not to be used within a couple of days of arrival, be certain to transfer it to a “normal” liquid nitrogen tank for indefinite storage. Extender for the semen will be shipped along with the tank. Extender may arrive in a concentrate or “ready-to-use” form. In all cases, proper directions for preparation, storage, and use of the extender will accompany the extender. If it is not to be used immediately, the extender should be stored in normal home-use freezer.

Steps to follow when thawing frozen semen straws:

Frozen semen needs to be thawed immediately prior to use. The procedure is simple but must be followed closely to maintain fertility.

- 1) Remove a bottle of the frozen extender from the freezer or obtain “ready-to-use” extender and warm to exactly 68°F (20°C). This may take the frozen extender 30 minutes to reach this temperature so plan ahead.

- 2) Place some tap water in a beaker or similar container and bring to 122°F (50° C).
- 3) Remove one straw from the liquid nitrogen tank. The canister should not be out of the liquid nitrogen for more than five seconds.
- 4) Place the straw in the 50°C water for 45 seconds. Do not try to hold onto the straw this entire time.
- 5) Remove the straw promptly from the 50°C water and wipe thoroughly dry with a paper towel.
- 6) Holding the straw vertically, snip the upper tip of the straw off with scissors. Place the open end over the opening of the bottle of extender and snip the other end to allow the semen to drain into the bottle. Rinse the straw by aspirating extender up in the straw and allowing it to flow back into the bottle.
- 7) Keep the semen in a covered Styrofoam box (Photo 10) until ready to inseminate the sow or gilt. This protects the sperm from sunlight and rapid temperature changes, which are detrimental. Use semen as soon as possible. Do not attempt to store it for long periods of time.

Steps to follow when thawing frozen semen pellets:

Frozen semen is also available in the form of frozen pellets (International Boar Semen). Follow these steps closely:

- 1) Thaw the thawing solution (extender). This can be accomplished in hot water or air. Be certain not to contaminate with water.
- 2) Place the thawing solution in a clean beaker and warm to 108°F in about one inch of water and a Styrofoam box.
- 3) Remove the semen from the tank. Use gloves to avoid frostbite. Allow the liquid nitrogen to drain out of the tube.
- 4) Immediately pour the pellets in a single layer on the bottom of a dry Styrofoam box. Let the pellets warm up for three minutes.
- 5) Immediately dump the pellets into the warm thawing solution and swirl gently. Pellets will be thawed in 15-20 seconds.
- 6) Remove the water from the outside of the beaker. Water is toxic to sperm.
- 7) Pour the thawed semen plus extender in a plastic insemination bottle.
- 8) Keep the semen in a covered Styrofoam box until ready to inseminate the sow or gilt. This protects the sperm from sunlight and rapid temperature changes which are detrimental. Use the semen as soon as possible. Do not attempt to store it.

Note: Always try to thaw and handle frozen semen in a room temperature (about 70°F) environment to avoid rapid temperature fluctuations that can damage sperm.

A few sources of boar semen (all breeds) are:

International Boar Semen
P.O. Box 538
Eldora, IA 50627
Phone: 1-800-247-7877 or 515-858-3411

Swine Genetics International
Rt. 1 Box 3
Cambridge, IA 50046
Phone: 1-800-247-3958 or 515-383-4386

Birchwood Swine Farm
Rt. 1 Box 130
West Manchester, OH 45382
Phone: 513-678-9313

Stoney Creek Farms
Rt. 2 Box 262
Farmland, IN 47340
Phone: 317-468-6099

Sources of A. I. Equipment for swine:

Edwards Agri-Supply, Inc.
Box 65
Baraboo, WI 53913
Phone: 1-800-284-2038 or 608-356-6641

NASCO
901 Janesville Ave.
Ft. Atkinson, WI 53538
Phone: 1-800-558-9595 or 209-519-6957

International Boar Semen
P.O. Box 538
Eldora, IA 50627
Phone: 1-800-247-7877 or 515-858-3411 .

Swine Genetics International
Rt. 1 Box 3
Cambridge, IA 50046
Phone: 1-800-247-3958 or 515-383-4386

References

Artificial Insemination in Swine. Diehl, Day, and Stevermer. Pork Industry Handbook. PIH-64.
AI Manual. Swine Genetics International, Inc. Rt. 1 Box 3, Cambridge, IA 50046.
1989 Boar Sire Directory. International Boar Semen, Eldora, IA 50627.

Equivalent temperatures for Celcius (Centigrade) and Fahrenheit

Equivalent temperatures for Celcius (Centigrade) and Fahrenheit

CELCIUS	FAHRENHEIT	CELCIUS	FAHRENHEIT
0	32	31	87.8
1	33.8	32	89.6
2	35.6	33	91.4
3	37.4	34	93.2
4	39.2	35	95
5	41	36	96.8
6	42.8	37	98.6
7	44.6	38	100.4
8	46.4	39	102.2
9	48.2	40	104
10	50	41	105.8
11	51.8	42	107.6
12	53.6	43	109.4
13	55.4	44	111.2
14	57.2	45	113
15	59	46	114.8
16	60.8	47	116.6
17	62.6	48	118.4
18	64.4	49	120.2
19	66.2	50	122
20	68	51	123.8
21	69.8	52	125.6
22	71.6	53	127.4
23	73.4	54	129.2
24	75.2	55	131
25	77	56	132.8
26	78.8	57	134.6
27	80.6	58	136.4
28	82.4	59	138.2
29	84.2	60	140
30	86	61	141.8

The Oklahoma Cooperative Extension Service

Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, Title IX of the Education Amendments of 1972, Americans with Disabilities Act of 1990, and other federal laws and regulations, does not discriminate on the basis of race, color, national origin, gender, age, religion, disability, or status as a veteran in any of its policies, practices, or procedures. This includes but is not limited to admissions, employment, financial aid, and educational services.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Robert E. Whitson, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 20 cents per copy. 0607