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KEYS TO PROFITABLE SMALL GRAIN PRODUCTION IN THE ROLLING PLAINS AND EDWARDS PLATEAU

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Soil and Climatic Conditions

Small grains are well adapted to deep, fertile soils of the Rolling Plains and Edwards Plateau. They normally are grown on fine-textured clay or loamy soils. Practically all small grains are fall-sown, since spring-sown grains usually yield and weigh less because of heat and dry weather.

Wheat is predominant in the area because of superior winter-hardiness, ready market demand and economic returns. Barley, less winter-hardy than wheat, produces profitable returns from winter pasture and grain on less soil moisture when managed properly. Oats, least winter-hardy of the four small grains, occupies very limited acreage in the area, although some varieties are seeded in the spring for livestock pasture. Rye is grown primarily for grazing and is more winter-hardy than wheat.

Small grains respond well to irrigation, which is available in limited quantities. Soils need adequate surface drainage to permit normal plant growth and root development, thus avoiding severe crop damage from grazing livestock.

Barley is the most tolerant and oats the least tolerant to soil salinity.

Rotations

Economics prevent many farmers from routinely rotating small grains with other crops. Producing small grains continuously on the same land increases the probability of damage from winter grain mites, brown wheat mites, soilborne diseases and weed problems such as mustards, cheat, wild oats and jointed goatgrass. Small grains grown in sequence with other crops, or rotated with fallow fields, result in more stable production. Rotations recommended include small grain-fallow-small grain, small grain-fallow-grain sorghum-fallow-small grain, or small grain-cotton-grain sorghum. Rotating wheat with Austrian Winter peas and guar has increased yields in this area. Rotations which require double cropping generally are not desirable in the dryland area. The fallow practice may not increase yields enough to justify the operation.

Seedbed Preparation

Seedbed preparation methods vary with the area, previous crop and soil type. Important considerations include (1) proper physical condition to allow rainfall penetration and conservation, (2) good surface drainage for normal plant growth and to avoid severe damage during grazing, (3) weed control, (4) wind and water erosion control and (5) avoidance of an accumulation of excessive undecomposed organic material in the seed zone near planting time. Reduced tillage is recommended for dryland production, although this practice may result in increased root rot, tan spot and other diseases and insect problems. When land is to be fallowed following a crop, use minimum tillage techniques such as sweep tillage for weed control, adequate water penetration and maintenance of crop residues to help avoid erosion.

Several drills on the market recently will drill through both standing and downed wheat stubble. These are usually equipped with narrow fluted, corrugated or ripple coulters and double disk openers to cut through the stubble. Depth bands, gauge wheels and/or press wheels are used for depth control in the trash or residue.

Use of herbicides or combinations of herbicides and reduced tillage are presently being used in an effort to conserve fuel, labor, soil and moisture.

Quality Seed

Use good-quality seed of an adapted variety. Seeds should be all one variety, have a high germination percentage and be free of other crop seed, weed seed

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Table 1. Small grain diseases, sources of infection and control suggestions.

Disease	Source of infection	Control suggestions
Leaf and stem rust	Airborne spores	Use resistant varieties when available. Bayleton®, with systemic activity, acts as both a preventive and a cure. Mancozeb (Dithane M-45® or Manzate 200®) are also registered and act as preventives only. Treatment is made before flag leaf damage.
Foot rot, root rot, crown rot, Septoria and other leaf spots	Crop residue, soil, airborne and seed-borne spores	Rotate with unrelated crops and practice good crop residue management. Treat seed with protectant fungicide. (See seed rots and seedling diseases.)
Loose smut of wheat and barley	Infected planting seed, infection takes place at heading time and infected seed appear the same as those uninfected.	Use seed free of loose smut infection. Treat planting seed with Vitavax®.
Loose smut of oats	Spores on seed coat	Loose smut of oats is not systemically seedborne as in wheat and barley. Use seed protectant fungicides.
Other smuts	Spores may be on seed or in soil	Use protectant fungicide as seed treatment
Wheat streak mosaic	Virus is transmitted by the wheat leaf curl mite.	Destroy volunteer wheat. Avoid early planting where this disease is a problem.
Yellow dwarf	Virus is transmitted by aphids.	Control aphids and use varieties that show less damage when infected.
Seed rots and seedling diseases	Seed and soilborne spores	Use seed protectant fungicides: Captan®, Maneb®, PCNB®, Phenyl Mercury®, Polyram®, Thiram® or Zineb®
Powdery mildew	Airborne spores	Plant resistant varieties. Foliar application of Bayleton® is effective.

and trash. Good seed is one of the most cost effective investments a grower can make.

Good quality seed is obtained at minimum cost by annually planting a small acreage to certified seed for next year's crop. Grow planting seed for this purpose on weed-free land. Give careful attention to weed and disease control to insure quality planting seed. Proper cleaning and seed treatments (see disease and seed treatment section), plus a germination test before seeding, help insure good stands.

For information on varieties adapted to your area, see your county Extension agent.

Diseases and Seed Treatment

Treat small grain with a seed protectant fungicide. Seed treatment helps prevent seedborne diseases, smuts, seed rots and seedling diseases (see table 1). Cleaning seed before treating helps eliminate weed seed and lightweight seed which often contain disease organisms that reduce yield.

Fertilization

Base fertilization programs on long-time averages and not on last year's production performance alone. Follow sound, consistent fertilization and soil management practices flexible enough to cope with seasonal moisture changes. Moderate nitrogen and phosphorus rates give economical yield increases in seasons of adequate rainfall. Potassium and other nutrients are seldom needed.

A soil test is the best way to determine fertilizer need. The amount of a given nutrient to apply depends on the level of that nutrient in the soil and cropping history, including residues, available moisture, grazing practices and general management. Information on the previous crop and grazing management to follow should accompany a soil sample to the Soil Testing Laboratory.

Small grains which are grazed need more fertilizer than ungrazed grain. Nitrogen increases forage production, but grazing also removes much of the nitrogen applied in the fall. Stocker cattle remove approximately 10 pounds of forage for each 1 pound of gain. Ten pounds of forage contain 0.4 pound of nitrogen. For each 1 pound of beef produced on wheat pasture, 0.4 pound of nitrogen has been removed from the crop. If the livestock are removed before the joint stage of wheat growth and conditions are favorable for grain production, replace the removed nitrogen by spring topdressing to harvest a normal grain crop. Nitrogen requirements are also higher when small grains follow grain sorghum and other high residue crops because of nitrogen tie up in the stalk decay process.

Applying fertilizer with the seed has proven to be a very efficient practice. All of the required phosphorus and up to 16 pounds of nitrogen per acre can be placed with the seed at planting. This practice increases early growth, root development, tillering, winter hardiness and resistance to diseases and insects.

Split fertilizer applications are preferred. Incorporate one-third to one-half of the nitrogen and all of the phosphorus into the soil before or at seeding time. Apply the remaining nitrogen in late winter before jointing. An 18-year average, from demonstrations in Baylor County, shows a 6.7-bushel-per-acre yield advantage to split applications of nitrogen over preplant applications. If all the nitrogen is applied in the fall, excessive growth of ungrazed forage may occur and chances of winter damage are increased. Nitrate leaching or denitrification can also occur before high nitrogen utilization by the crop.

Without soil test information, the following general rates of nitrogen and phosphorus are suggested, except when following heavily fertilized crops where no phosphorus may be needed or where a nitrogen-producing legume has preceded small grain:

- *Not grazed.* Fifteen pounds of nitrogen plus 20 pounds phosphate in the fall, followed by 30 to 50 pounds of nitrogen in the spring, if moisture is adequate.
- *To be grazed.* Thirty pounds nitrogen plus 20 pounds phosphate in the fall, followed by a spring application of nitrogen based on grain yield projections. The fall nitrogen application is for forage production. Base the spring nitrogen application on potential grain yield. Some estimates of nitrogen removal by stocker cattle is that 0.4 pound of nitrogen is removed for each 1 pound of beef gain produced.

Irrigation

According to Texas A&M researchers, Dr. C. J. Gerard, et al. (1975-78), a 50-bushel-per-acre wheat yield can be produced at Chillicothe with as little as 15 inches of available water. Seven inches of water are required to produce grain. Each 1 inch above 7 inches produced 6 bushels per acre. Data from other areas indicate that for each 1 inch of available moisture 2.6 to 3.5 bushels of wheat per acre can be produced. One fall irrigation is often necessary for good livestock grazing. If planting moisture is adequate, this irrigation may be made following emergence or 2 to 3 weeks before grazing. A second irrigation may be required in January or early February, depending on moisture received.

When irrigation water is limited and moisture is deficient, consider preplant irrigation since a longer period can be required for wetting the soil profile. In the spring, apply water for optimum soil moisture during the peak use period of booting, heading, flowering and milk growth stages. Irrigation timing cannot be predicted in advance because of rainfall variations and other weather conditions. Apply the first irrigation normally at or before the boot stage of growth to alleviate stress during early grain fill.

For further information, obtain L-355 *How to Estimate Soil Moisture by Feel,* and L-754 *Soil Moisture Storage* from your county Extension agent.

Seeding Dates and Rates

Suggested seeding dates for grain and forage production are from September through October. For grain production only, seeding dates vary from mid-September in the northern part of the area to December in the southern portion.

Heavy seeding rates do not appreciably increase total forage. Early production is favored to some extent by heavier seeding rates. In the past, the following general seeding rates have been suggested:

Crop	Seed/acre dryland	Seed/acre irrigated
Wheat	60 lb	75 lb
Oats	64 lb	80 lb
Barley	48 lb	72 lb
Rye	45 lb	75 lb

With the many new varieties on the market, seed size varies greatly. Examples of these differences follow:

Variety	Grams per 1,000 kernels	Kernels per square ft at 60 lb per acre seeding rate
Tam 101	38	16.6
Tam 105	37	17.3
Hawk	42	14.9
Vona	25	24.7

This illustrates that a 40-pound-per-acre seeding rate of Vona will result in the same number of seed per square foot as 60 pounds of Tam 105.

Increase seeding rates by 20 percent if seeding is after November 15. Late seedings normally do not tiller as well as early seedings. Consider additional phosphorus to enhance tillering and root establishment.

Weed Control

Most weeds can be controlled mechanically during seedbed preparation or with preplant, preemergent or postemergent herbicides. Planting weed-free seed and rotating crops reduce weed populations.

Herbicides available for controlling broadleaved weeds include dicamba (Banvel®), bromoxynil (Brominal® or Buctril®), 2,4-D, MCPA and chlorosulfuron (Glean®). Glean can be applied preemergence or postemergence. All of the other herbicides are applied postemergence. The table below gives rates and application suggestions.

Table 2. Herbicides applied postemergence for controlling broadleaved weeds.

Herbicide	Rate/acre	Time of application	Precautions
chlorosulfuron (Glean®)	1/6-1/2 oz	Preemergence or postemergence plus a surfactant when weeds are less than 2 in tall	Do not use in oats. Follow label closely concerning crop rotation.
dicamba (Banvel®)	4 fluid oz	After emergence to joint stage of wheat, oats or barley	Read and follow label. Avoid drift to susceptible crops.
bromoxynil (Brominal®, Buctril®)	Brominal ME4 1/2 - 1 pt Buctril 2EC 1 1/2-2 pt	After emergence to boot stage of wheat, oats or barley	Apply while weeds are small. May be tank mixed with other herbicides. Do not graze for 30 days after application.
MCPA	1/2 to 1 1/2 pt active ingredient	When wheat, oats or barley is in three- to four-leaf stage but before early boot stage and while weeds are small	Prevent drift to susceptible crops.
2,4-D	1/2 to 2 pt	Apply after grain is fully tillered but before boot stage of wheat, oats and barley. May also be applied after soft- to hard-dough stage	The high rate may cause injury. Oats are more susceptible to injury. Avoid drift to susceptible crops. Do not graze animals for 7 days after application.

Herbicides labeled for grass-type weeds such as wild oats and bromes (cheat) include triallate (Far-Go®), difenzoquat (Avenge®), barban (Carbyne®) metribuzin (Sencor® or Lexone®) and diclofor methyl (Hoelon®). Avenge and Carbyne are applied postemergence and Far-Go is applied preplant incorporated. Hoelon may be applied either preemergence or postemergence. Lexon or Sencor result in effective control but have some limitations for this area. They may injure varieties other than Tam 101, Tam 105, Newton or Hawk. Do not use on sandy soils or soils with less than 1 percent organic matter or a pH greater than 7.7. Avenge, Carbyne and Hoelon are of limited value in this region because treated fields cannot be grazed.

Presently the most successful methods for controlling wild oats and brome grasses are crop rotation and heavy grazing to prevent seed formation.

Field Bindweed Control. Field bindweed (tievine) is the most widespread perennial weed in small grains. Large infestations are most economically controlled with repeated tillage at 3-week intervals during the fallow period between crops. If rainfall delays tillage, wait 2 weeks and apply 2,4-D or Banvel. Discontinue tillage about September 1 and allow bindweed to grow to the flowering stage. In mid-October apply Banvel at 1 quart per acre or picloram (Tordon 22K) plus 2,4-D (1/2 to 1 pint plus 1 to 2 pints per acre). Fifty to 75 percent control can be expected. Do not plant small grains for several months, depending upon rate and herbicide applied. Delay 45 days before planting for each pint of Banvel.

Reduced Tillage Systems. Herbicides labeled for use in the fallow period of a continuous reduced tillage wheat production system include glyphosate (Roundup®), paraquat (Ortho Paraquat®, Gramoxone®), dicamba (Banvel®), cynazine (Bladex®) and terbutryn (Igran®).

Roundup or paraquat are used to kill emerged weeds and volunteer wheat following harvest. Igran or Bladex are used for preemergence and residual weed control in the fallow period. Applications of short residual herbicides such as Igran or Bladex soon after harvest allow wheat to be safely seeded in the fall, yet may eliminate the need for summer cultivation. Banvel is used to control broadleaved weeds only.

A typical, reduced till, wheat weed control program includes 1/3 to 1/2 ounce per acre Glean applied in March and 12 ounces of Roundup plus 1/2 ounce surfactant per acre or 16 ounces paraquat plus 1/2 percent surfactant per acre following wheat harvest to control volunteer wheat and emerged weeds.

This should eliminate one or two summer cultivations. To further eliminate the need for summer cultivation Igran 80W at 2 to 2 1/2 pounds per acre or Bladex 80W at 2 1/2 to 3 1/2 pounds per acre may be added in a tank mix with paraquat.

For detailed weed control information see the current Texas Agricultural Extension Service publication *Suggestions for Weed Control with Chemicals in Small Grains* or contact your county Extension agent.

Insect Control

Insects and mites attack small grain pests from planting until grain is nearly ready to harvest. The ability to identify damaging pests and beneficials and to determine population levels is a basic requirement for managing these pests. Inspect fields weekly when weather conditions are favorable for rapid pest population development.

Soil pests such as false wireworms and wireworms can injure fall-sown wheat stands by destroying seeds. Seeds planted too early or "dusted in" are more likely to be damaged. To avoid much of the injury caused by these soil pests use clean culture and plant when adequate moisture is available. Rotating with a crop such as cotton and fallowing also aids in control. Fields previously planted to corn, sorghum or some grass and rotated to a small grain are most likely to be damaged by false wireworms or wireworms. When this situation occurs, consider a thorough inspection of the top 6 inches of soil to determine if chemical control measures are needed. Insecticidal control by seed treatment, banding or broadcasting the insecticide is effective for control.

The white grub is the larval stage of an insect commonly known as May or June beetles. White grubs damage plants by feeding on the roots. Small plants are often killed, resulting in stand loss. Replanting after larvae have moved deeper into the soils assists in stand establishment. Broadcast insecticide application before planting for effective white grub control.

Cutworm damage is usually limited to seedling plants near field borders where grasses and weeds serve as hosts for the developing cutworms. Damaged seedlings are cut off near the soil surface.

The armyworm cutworm is adapted to arid conditions and is a damaging pest in the Rolling Plains and Edwards Plateau areas of Texas. Only one generation occurs each year, and the partially grown larvae feed during warmer periods from December through April. Army cutworms cut off small grain plants near the soil surface leaving little more than the crown and roots. Larvae are usually found in loose soil near damaged plants, and heaviest damage is often near volunteer small grain on the field margins. Eliminating volunteer small grain and weeds aids in controlling army cutworms and other cutworms.

Foliage feeders, such as fall armyworms and armyworms, can destroy seedling stands when weather conditions are extremely favorable for these pests. Damage in the fall is heaviest in fields that were planted early for grazing. In the spring, cool, damp weather following a mild winter creates conditions favorable for armyworm population development. Damage often occurs first in the part of the field where small grain is making the most luxurious growth.

The greenbug is the most damaging of the pests found in small grains. Weather conditions are the major factor contributing to a greenbug outbreak. Optimum temperature for greenbug reproduction is 75° F., but greenbugs can reproduce at temperatures from 55° to 95° F. When temperatures are in the 65° to 85° F. range greenbug populations increase rapidly and often go undetected until they have caused excessive damage. Damaging greenbug populations are most likely to occur when temperatures are in the optimum range in November and December and from mid-February to the end of March. Greenbug reproduction and activity are reduced by temperatures below 50° F. When temperatures remain below freezing for a week with daily lows below 20° F. reduced greenbug populations can be expected. Heavy rain, sleet and snow may also reduce greenbug populations.

Several beneficial insects and spiders are predators or parasites of greenbugs. A parasitic wasp and the convergent lady beetle are the most important. These beneficials become active at temperatures above 65° F. and can reduce populations of greenbugs and other aphids as warmer temperatures prevail from March through May.

Insecticidal control of greenbugs depends on size, condition and stage of plant growth, number of greenbugs present, temperature, moisture conditions and presence or absence of parasites and predators. The following table is a general guide for determining the need for insecticidal treatment of greenbugs.

Plant height (in)	Number greenbugs per linear ft
3-6	100-300
4-8	200-400
6-16	300-800

The appearance of small dead areas caused by greenbugs feeding indicates the need to inspect the field and evaluate the greenbug situation. Occasionally, populations of 25 to 50 greenbugs per linear foot of row on small plants may warrant treatment.

The oat bird-cherry aphid and the cornleaf aphid seldom cause economic damage. These aphids do not inject toxins into the small grain plants when they feed as is the case with the greenbug. Barley yellow dwarf virus is transmitted to small grains by aphids, but control is not economically justified.

Aphid infestations are lighter in small grain fields that are grazed. The heavier the grazing pressure, the smaller the aphid population will be.

Winter grain mites damage small grains in the eastern part of the area but seldom cause damage in the western part. The mites feed primarily at night and remain around the base of the plant during the day. Activity is retarded during hot, dry weather and greatest damage occurs during winter and early spring. These mites cause leaf tips to turn brown and plants to become stunted with a silvery-grey appearance. These symptoms and the presence of mites indicate the need for control measures. Rotating with warm season crops greatly reduces infestation levels. Mites are heaviest in fields where small grains are produced year after year.

Brown wheat mites damage small grains during dry weather, and their damage in some respect resembles drought damage. Heavy rains reduce mite populations. Chemical control of these mites seldom produces an economic yield increase.

Information on these and other small grain pests and pesticides suggested for their control is presented in B-1251 *Insect and Mite Pests of Small Grains-Management Approaches.*

Grazing Practices

Wheat, oats, barley and rye usually provide a source of green forage for livestock during late fall, winter and early spring. Barley grows more rapidly in the fall and furnishes pasture more quickly than other small grains. Returns from grazing small grains often exceed grain value, depending on livestock and grain prices.

Controlled grazing may not seriously reduce grain yield. Forage value should more than offset any losses in grain production, provided grazing ceases at the proper time.

Rank, succulent small grain plants are easily damaged by low temperatures. Properly controlled grazing may reduce low temperature damage and save the crop for grain. Early spring pasturing reduces yields only slightly; late spring pasturing reduces yields severely.

Young small grain plants are damaged by severe defoliation. Delay grazing until plants are well established and 5 to 6 inches tall.

Practice stocking rates light enough to avoid continuous, complete removal of top growth. If a grain crop is desired, remove livestock in the Rolling Plains-Edwards Plateau area of Texas no later than March 1 to 15. To avoid injury, remove livestock before plants begin to joint and before the growing point, which is starting to develop into a head, gets far enough above ground level to be removed by grazing.

Barley and rye, earlier in heading than wheat or oats, may be injured more by late grazing. Kansas research show grazing wheat delayed maturity from 1 to 4 days. The more closely wheat was grazed, the later it matured.

Late spring grazing retards wheat maturity and causes grain to shrivel. Grazing may be harmful on sandy soils or on thin, poor stands. Removing top growth on sandy soils may lead to excessive wind erosion. Thin stands also may be damaged by livestock trampling and pulling up plants. Do not graze all top growth; leave some to hold the soil and provide plant protection.

Harvesting

Begin harvest when grain moisture content is reduced to 12 to 13 percent. Proper combine adjustment keeps harvest losses to a minimum. Wheat varieties vary in tightness of chaff and ease of threshing. Oats, with a weaker straw than wheat or barley, sometimes presents additional harvesting problems. Wind, hail and rain may cause severe lodging, increased harvesting cost and reduced grain quality. Where lodging or shattering occurs or threatens, where weeds are a problem or when grain ripens unevenly, windrow oats and use a pickup attachment to combine the crop. An oat crop is usually damaged less by rains when in windrows than if standing full ripe.

Oats in the soft dough growth stage may be used for ensilage. A good oat crop yields 6 to 10 tons of silage and can be made into silage earlier in the season than other crops. Oats also makes a valuable hay crop when cut while the leaves and stems are still green and the grain is in the soft dough stage. Oat straw is the most palatable and nutritious of cereal straws.

Wheat can be made into good quality hay if cut at the boot stage when crude protein content should run 14 to 15 percent. Once the crop is fully headed, crude protein is reduced 50 percent. Yield should average 2 tons per acre.

Barley can be made into good quality hay if cut at the early dough stage before the awns harden; however, it is not used extensively for hay.

Spring Seeding

Spring seeding of wheat, oats and barley is not recommended because yields are much lower than for fall-seeded varieties. When a fall-seeded crop is winterkilled or not established because of adverse conditions, spring seeding may be substituted, but expect lower yields and quality. Spring seeding rates should increase by one-third or more.

Grain Marketing

Grain producers have several marketing options. They may (1) contract their crop at a given price to a local buyer before harvest, then deliver the grain at harvest for cash; (2) "hedge" their growing crop on the futures market, then liquidate the "hedge" at harvest and deliver the grain to a local buyer for cash; (3) deliver and sell their crop at harvest to a local buyer for cash; (4) store the harvested crop either on-farm or in a commercial elevator for cash sale later; or (5) place the harvested crop in an approved facility where government loan is available for cash sale later either to a local buyer or by redeeming the loan and delivering title of the grain to the government. Producers suitably equipped may choose to market all or part of their crop for seed purposes.

Each method has advantages and disadvantages. For example, where the producer elects to store grain at his expense for cash sale later, compute estimated dry matter and moisture shrinkage along with storage-handling and interest costs, as well as quality maintenance problems. Compare these costs with expected future changes in cash prices to determine the profitability of this option.

Economics of Production

Increased production efficiency can be achieved by adopting practices proven profitable through research and result demonstrations. Make decisions to adopt improved production practices by considering added costs versus added returns from change in practices. First consider production practices which affect costs and/or income most. Soil fertility, moisture management, insect control, weed control, disease control, variety selection and harvesting influence the profitability of small grain.

Adequate records and accounts are necessary for measuring progress and making changes in production practices.

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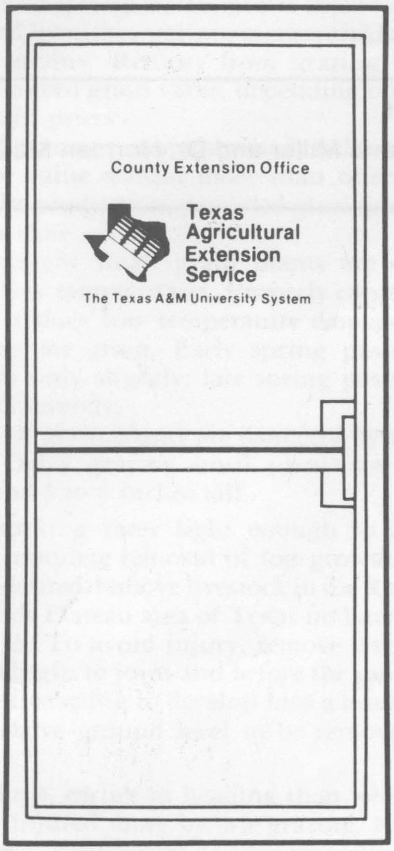

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