Rec'd 15,000 9-2-69
new - Hodges

FACT SHEET

L-852

KEYS TO PROFITABLE SMALL GRAIN PRODUCTION ON THE HIGH PLAINS

R. J. Hodges*

Soil and Climatic Conditions

Small grains are well adapted to deep, fertile soils of the High Plains. Most small grains are planted in the fall since spring-sown grain normally yields and weighs less because of heat and dry weather. Wheat is the most used small grain because of superior winter-hardiness and greater economic returns. Barley, less winter-hardy than wheat, provides profitable returns from winter pasture and grain on less soil moisture when properly managed. Oats, the least winter-hardy of the four small grains, occupies minor acreages on the High Plains.

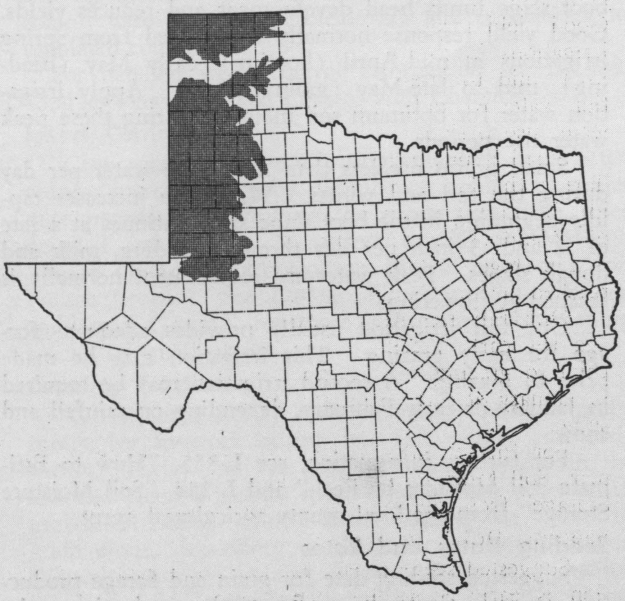
About 45 percent of the wheat acreage is irrigated. Oats and barley are more subject to shattering losses from wind and hail than wheat. Rye, the most hardy cereal, occupies some acreage on sandy soils to which it is best adapted. Rye produces some grazing forage during coldest winter months when other small grains cease growth.

Rotation

Failure to rotate small grains with other crops increases brown wheat mites, winter grain mites and soil-borne diseases. Volunteer grain, infected with the wheat streak mosaic virus, hosts the leaf curl mite which transmits the disease. Rotations to use under dryland conditions are: (1) small grain - sorghum - small grain; (2) small grain - fallow; (3) small grain - small grain - fallow.

On irrigated land, rotations to consider are: (1) small grain - grain sorghum - soybeans; in a 3-year rotation (2) small grain - soybeans - cotton; in a 2-year double crop rotation (wheat, soybeans the same year); (3) small grain - grain sorghum - cotton; in a 3-year rotation. Other rotations may be developed for local situations.

*Extension agronomist and coordinator of this fact sheet, which contains contributions by numerous staff members in the College of Agriculture, Texas A&M University.



High Plains Area

Seedbed Preparation

Seedbed preparation methods vary with the area, previous crop and soil type. Consider (1) proper physical condition for penetration and rainfall conservation; (2) good surface drainage for normal plant growth and to avoid severe grazing damage; (3) weed control; (4) wind and water erosion control; and (5) excessive residue accumulation in the seed zone.

Stubble-mulch tillage, recommended for dryland production, may perpetuate root rot, other diseases and insect problems. Slightly higher yields have been obtained on subtilled land than on plowed or one-wayed land and damage from blowing sand is reduced. Delayed fallow, leaving the stubble of the previous crop standing until spring, retards runoff and holds snow, increasing soil moisture at seeding.

Seedbed preparation for surface irrigation sometimes requires shredding stubble from the previous crop. Turn residue under with a disc or moldboard plow to permit levelling and listing operations. Control weeds and volunteer grain with the usual tools. In many cases, the land may be leveled and then listed.

Harrowing before seeding reduces bed and ridge height. The small grain is then sown with a disc drill on the beds and in the furrows, which are used for water control during flood irrigation. If sprinkler irrigation is used, prepare the seedbed essentially the same as for dryland small grains.

Quality Seed

Use good-quality seed of an adapted variety. Planting seed should be of high germination, plump, true to variety and free from other crop, weed seed and trash. Trash in planting seed affects drill operation, causing poor seed distribution and uneven stands. Certified seed meets the above requirements.

Good quality seed is obtained at minimum cost by annually planting a small acreage to certified seed and saving seed from this crop for the next year's acreage. Seed, produced in this manner or purchased from a

Texas A&M University • Agricultural Extension Service • John E. Hutchison, Director • College Station

neighbor, should be grown on land free of noxious weeds. Proper cleaning and seed treatments, plus a germination test prior to seeding, helps insure good stands.

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

Seed Treatment

Treat small grain seed with an approved fungicide and insecticide, if needed. Certified seed generally are treated with a fungicide. Seed treatment is good insurance against seedling blights and some smuts. Several effective fungicides with suggested rates follow:

CHEMICAL (TRADE NAMES)	WHEAT, OATS AND BARLEY
Agrox	½ oz. per bushel
Ceresan L	½ oz. per bushel
Ceresan M	½ oz. per bushel
Chipcote 25	¼ oz. per bushel
Chipcote 75	¾ oz. per bushel
Mer Sol 48	¾ oz. per bushel
Ortho LM	¾ oz. per bushel
Panogen 15	¾ oz. per bushel
Panogen 42	¼ oz. per bushel

For production of *planting seed only,* Vitavax Seed Protectant may be used to control loose smut of barley and wheat. Apply 4 ounces of Vitavax per 100 pounds of seed. The material is compatible with commonly used seed treatments. Do not treat seed with Vitavax if the crop is to be sold for grain.

Fertilization

Soils vary greatly in ability to supply plant nutrients; however, most all soils are deficient in nitrogen, needed most by small grains. Phosphorus, the second plant nutrient limiting production, is needed by only 50 percent or less of the wheat-producing soils. No increase in grain yields has been observed in research work from potassium application.

If a soil test is not available, 120 pounds nitrogen is recommended to produce 60 bushels of moderately grazed wheat. If the soil is deficient in phosphorus, apply 40 to 60 pounds P_2O_5.

APPLICATION METHODS

Chisel nitrogen and phosphorus into the soil before land preparation or broadcast and disc in or plow in before final seedbed preparation. Place ammonia at a 6 to 8-inch depth so there is no detectable odor above chisel furrow. Eighteen-inch centers are close enough to avoid streaking. Cover solid or liquid nitrogen materials, particularly those containing urea, soon after application or irrigate into the soil.

Broadcast phosphorus generally is as effective as banded. Phosphorus must be placed in the soil at the permanent root zone, since this element does not move appreciably from point of application.

Do not apply nitrogen or potassium fertilizers in direct contact with seed.

TIME OF FERTILIZER APPLICATION

Nitrogen: On Pullman and similar clay loam soils where wheat is not to be grazed, comparable grain yields can be expected when nitrogen is applied (1) all preplant, (2) half preplant and half top-dressed in February and (3) all top-dressed in February before plants begin to joint and make upright growth. On clay loams where crop is to be grazed, apply all or part of the nitrogen preplant with remainder applied before joint stage.

On soils with rapid water intake rate, nitrogen can be lost through leaching by rainfall or irrigation. On these soils, apply one-third to one-half the nitrogen preplant and the remainder top-dress.

Phosphorus: Apply phosphorus in the seedbed before planting to stimulate vigorous root system development and early vegetative growth. Surface applications after planting generally are not effective for the current crop. Adequate phosphorus is essential for winterhardiness and profitable yields of forage and grain.

Potassium: Apply potassium where needed before planting.

Dryland Fertilization

Under dryland conditions, fertilizer response cannot be expected on fine textured soils, such as the Pullman silty clay loam. Many years of research on the High Plains show no increased forage or grain yields from the use of nitrogen and phosphorus on these soils.

On sandy soils, where native fertility is low, use 20 to 30 pounds of nitrogen before planting. If February moisture conditions are favorable, an additional 20 to 30 pounds of nitrogen can be profitable for grain production. When grazing is the major objective, apply higher nitrogen rates in the fall. Apply phosphorus at 20 to 30 pounds of P_2O_5 per acre before seeding when a soil test indicates need.

Irrigation

About 28 inches of usable water during a growing season produces 40 to 50 bushels of wheat or 60 to 90 bushels of oats or barley. This moisture may be supplied from water previously stored in the soil, rainfall or supplemental irrigation.

Adequate moisture during early growth develops well-tillered crowns and strong root systems. Water from pre-plant or watering-up irrigations normally meets this early water requirement.

Light irrigation in the early spring during the tillering and jointing stage is needed during dry years and after grazing, following a top-dressing of nitrogen. Heavy irrigation is not recommended during tillering and jointing since it produces more straw, encourages lodging and seldom increases yields significantly. Research shows that moderate moisture stress during early spring growth does not reduce yields seriously if adequate moisture is available by boot stage.

Soil moisture conditions at booting, heading and grain filling growth stages are particularly important. Insufficient moisture during and immediately following boot stage limits head development and reduces yields. Good yield response normally is obtained from spring irrigations in mid-April (booting), early May (heading), mid to late-May (grain filling). Apply irrigation water for optimum soil moisture during these peak water use periods.

Small grains use less than .1 inch of water per day during the fall and winter. Water use increases rapidly beginning in the boot stage and continues at a rate of .2 and .3 inch per day through heading, milk and dough stages. Peak water-use requirement normally is reached at flowering.

One fall irrigation usually provides adequate forage for early grazing. This irrigation may be made prior to grazing. A second irrigation may be required in January or early February, depending on rainfall and snow.

For further information, see L-355, "How to Estimate Soil Moisture by Feel," and L-754, "Soil Moisture Storage" from the local county agricultural agent.

Seeding Dates and Rates

Suggested seeding date for grain and forage production is early September. For grain production only, September 15 to October 1 is satisfactory.

DESCRIPTION AND SUGGESTED CONTROL OF SMALL GRAIN DISEASES

DISEASE	SOURCE OF INFECTION	CONTROL SUGGESTIONS
Leaf rust and stem rust	Air-borne spores	Use resistant varieties when available. Experimental fungicides look promising, but are not approved for use.
Foot rot, root rot, Crown rot, septoria and other leaf spots	Crop residue in soil and air-borne spores. Seed-borne.	Rotate with unrelated crops and practice good crop residue management. Treat seed with protectant fungicide.
Loose smut of wheat and barley	Fungus is present within infected seed. Infection takes place at flowering time and infected seed appear the same as those uninfected.	Use seed free of loose smut infection. Do not locate fields producing planting seed near commercial fields where many loose smut spores may be produced.
Other smuts	Spores of fungus may be present 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.

Heavy seeding rates do not increase appreciably total forage production. Early forage production is favored to some extent by the heavier seeding rates. On this basis, the following seeding rates are suggested:

CROP	SEED/ACRE DRYLAND	SEED/ACRE IRRIGATED
Wheat	30 lb.	60 to 75 lb.
Oats	64 lb.	80 lb.
Barley	48 lb.	72 lb.
Rye	45 lb.	75 lb.

Weed Control

Control weeds during seedbed preparation or with herbicides after plants are established. Good crop rotation and weed-free planting seed are essential for weed control. Control small annual and perennial broadleaf weeds with ½ to 1 pound per acre of 2,4-D amine or ester. Apply 2,4-D after the grain has tillered or as late as the mid-joint stage. Applications of 2,4-D made prior to and during boot, heading and flowering stages cause reduced yields. Spraying after April 1 is not profitable because weeds have competed seriously for soil moisture. Large weeds in poor stands of small grain can be controlled with 1 pound per acre of 2,4-D applied after the soft dough stage. Apply early. Approximately 2 weeks is required for 2,4-D to kill large weeds. Herbicide drift may affect crops, such as cotton and vegetables. Users of hormone-type herbicides must comply with the State herbicide law and regulations, in regulated counties.

For detailed weed control information see B-1029, "Suggestions for Weed Control with Chemicals."

Insect Control

Crop rotation and eliminating volunteer grain often reduces insect damage by diminishing aphid and spider mite populations, breaking the production cycle. See detailed information on insect control in MP-339, "Texas Guide for Controlling Insects on Grain and Forage Crops." See L-819, "Greenbugs on Sorghum and Small Grains," for more information about aphid species on small grains.

Grazing Practices

Wheat, oats, barley and rye usually provide green forage for livestock during late fall, winter and early spring. Barley and rye grow off more rapidly in the fall and furnish pasture more quickly than other small grains. Grazing returns often exceed the value of grain alone, depending on livestock and grain prices. Properly managed grazing causes little or no reduction in grain yields, provided livestock are removed before the jointing or upright growth stage is reached. The date for livestock removal is March 1 and March 15 for the south and north High Plains, respectively. Barley and rye mature earlier than wheat or oats and may be injured more by late grazing.

Properly controlled grazing also minimizes freeze damage to rank, succulent plants.

Delay grazing until plants are well established. Maintain a stocking rate which prevents complete removal of top growth. Excessive grazing weakens the root system and results in slow recovery. On sandy soils, over-grazing can contribute to wind erosion and stand reduction.

Harvesting

Begin harvest when moisture content of the grain has attained the proper level for available handling and storage facilities. This is usually 12 to 13 percent under High Plains climatic conditions.

Proper combine adjustment avoids waste, cracking and excessive trash. Since moisture in the grain varies during the day and throughout the harvest period, adjust the speed of the cylinder accordingly. Excessive trash and cracked grain favor stored grain insects and mold development detrimental to quality and acceptance of the grain for food or feed.

Oats have weaker straw than wheat or barley, sometimes causing additional harvesting problems. Storms, wind and rain may cause severe lodging of oats, increasing harvesting cost and reducing grain quality. Where lodging or shattering threaten oats, where weeds are a problem or when grain ripens unevenly, windrow the oats and use a pickup attachment to combine the crop. An oat crop usually is damaged less by rains when in the windrow than if standing full ripe.

Spring Seeding

Spring seeding of wheat, oats and barley is not recommended since yields are lower than fall-seeded varieties. Spring-seeded crops are seeded and must become established during a period of low rainfall, cool temperatures, high winds and spring freezes. When the fall-seeded crop is winterkilled, spring seeding may be substituted, but look for lower yields and quality.

Grain Marketing

Grain producers 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 their harvested

crop either on-farm or in a commercial elevator for cash sale at some later date; or (5) place their harvested crop in an approved facility where government loan is available for cash sale at some later date either to a local buyer or by redeeming the loan and delivering title of the grain to the government.

Each marketing method has advantages and disadvantages. For example, if the producer stores grain at his expense for cash sale at a later date, estimated dry matter and moisture shrinkage must be computed, along with storage-handling and interest costs. These costs must be compared with expected future changes in cash prices to determine the profitability of this option.

Table 1. Estimated Yield, Price, Income, Production Costs, Harvesting Costs and Income Over Specified Costs per Acre for Irrigated Wheat, Oats and Barley

	Wheat	Oats	Barley
Yield—Bushels per acre	50	90	80
Price—dollars per bushel	1.25	.75	.90
Grazing—4 mo @ $5/ac/mo	20.00	20.00	20.00
Income—dollars per acre[1]	82.50	87.50	92.00
Preharvest costs per acre			
Seed—(wheat 1 bu., oats 2½ bu., barley 1½ bu.)	$ 2.50	$ 3.75	$ 3.75
Fertilizer, 80-0-0	4.00	4.00	4.00
Insecticide and application	2.00	2.00	2.00
Machinery (Discing and planting only)	.80	.80	.80
Irrigation—18 acre inches	11.36	11.36	11.36
Labor	3.14	3.14	3.14
Insurance	4.00	4.00	4.00
Custom list and fertilizer application	1.50	1.50	1.50
Interest on operating capital—8% for 6 mo.	1.17	1.22	1.22
Total specified preharvest costs/acre	$30.47	$31.77	$31.77
Harvesting costs			
Combine and haul—custom 15¢/bu.	$ 9.00	$13.50	$12.00
Total specified preharvest and harvesting costs	$39.47	$45.27	$43.77
Income over specified costs[2]	$43.03	$42.23	$48.23

Table 2. Cultural Practices, Usual Dates, Times over Hours per Acre, Cost per Hour, Cost per Acre and Harvesting Irrigated Wheat, Oats and Barley

Cultural practice	Usual dates	Times over	Hours per acre		Cost per hour		Cost per acre	
			Labor	Machinery	Labor	Machinery	Labor	Machinery
Disc	July-Aug	3	.51	.42	$1.50	$1.27	$ .78	$ .53
List & Fert[3]	Aug	1	Custom					
Plant	Sept	1	.25	.21	1.50	1.27	.38	.27
Irrigate[3]	Seasonal	4	1.32		1.50		1.98	
Spray	April	1	Custom					
Harvest	June-July	1	Custom					
Total			2.08	.63			$3.14	$ .80

Table 3. Estimated Yield, Price, Income, Production Costs, Harvesting Costs and Income Over Specified Costs per Acre for Dryland Wheat, Oats and Barley

	Wheat	Oats	Barley
Yield—bushels per acre	15	25	20
Price—dollars per bushel	1.25	.75	.90
Grazing—4 mo @ $1.50/mo/ac	6.00	6.00	6.00
Income—dollars per acre[1]	$24.75	$24.75	$24.00
Preharvest costs per acre			
Seed—(wheat ½ bu., oats 2 bu., barley 1 bu.)	$ 1.25	$ 3.00	$ 2.50
Insecticide and application	2.00	2.00	2.00
Machinery	.80	.80	.80
Labor	1.16	1.16	1.16
Insurance	1.50	1.50	1.50
Interest on operating capital—8% for 6 mo.	.27	.34	.32
Total specified preharvest cost/acre	$ 6.98	$ 8.80	$ 8.28
Harvesting cost			
Combining—custom	$ 4.00	$ 4.00	$ 4.00
Hauling—custom 5¢/bu	.75	1.25	1.00
Total specified harvesting costs	4.75	5.25	5.00
Total specified preharvest and harvesting costs	$11.73	$14.05	$13.28
Income over specified costs[2]	$13.02	$10.70	$10.72

[1]Income does not include any government payments.
[2]Costs do not include unallocated overhead costs such as interest, taxes and insurance on farm real estate and machinery, depreciation on farm buildings and machinery and pickup expense.
[3]Practice does not apply to dryland budget.

Cooperative Extension Work in Agriculture and Home Economics, Texas A&M University and the United States Department of Agriculture cooperating. Distributed in futherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
15M—8-69