Stand Establishment of Small Grains and Annual Grasses for Grain and Winter Pastures

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Texas farmers and ranchers plant in excess of 8 million acres of small grains and winter annual grasses. Crops such as wheat, oats, barley, triticale and rye, generically known as "small grains", are planted for a variety of purposes. These include production solely for grain, dual purpose grain and winter pasture, winter pasture only, silage or as a cover crop to reduce erosion during the fallow period between summer annual crops such as cotton. Another common winter annual forage grass is Italian ryegrass. Ryegrass, unlike the small grains, cannot be harvested for grain, but is used for grazing, hay production or as a cover crop.

Without question, the key to achieving acceptable yields of forage and/or grain in these crops is the successful establishment of a uniform stand with a plant population adequate to take advantage of environmental conditions in the region in which the crop is planted. For example, in the dry climates of west Texas, an adequate plant population for dryland wheat would be one-third to one half of that considered normal and adequate in the higher rainfall regions of the north Texas Blacklands, or in an intensive irrigated production system of the northern High Plains. Producers who plant with a goal of early fall forage production will require a higher plant population than producers whose goal is only grain production.

Small grains stand establishment

Proper seedbed preparation and the selection of seeding rate are important management consider-ations for successful production of small grains. Optimum seeding rate is determined by potential yield of forage and grain as well as the intended use of the crop: does the farmer plan to intensively utilize forage, or is the primary intent to produce grain. Best stands are achieved when seed are planted to a uniform depth and seed is in close contact with a warm, moist soil. Stand failure is commonly associated with variables such as planting too deep, loose or fluffy seedbeds which don't allow for proper control of seeding depth, poor quality seed, light, erratic rainfall following planting which does not supply adequate moisture for germination, seedling diseases, and insects. As with many other crops, timely and adequate rainfall coupled by favorable temperatures cover up many deficiencies in seedbed preparation. Such conditions can result in a successful stand when seed was planted in less than ideal conditions. Due to the relative success in achieving good stands under optimum rainfall conditions, farmers in the higher rainfall regions of the state may traditionally use practices which are near guarantees for stand failure in the low rainfall areas of the state.

Broadcast versus drill planting of small grains

Stands of small grains are typically established by two different approaches: broadcasting and drill planting. Broadcasting is achieved through a uniform distribution of the seed on the soil surface by means

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of such devices as an airplane, spinner applicator, or air boom truck. One key to success with these techniques is uniform distribution. If there is a great difference in seed distribution between the edges of the planting swath, there is little hope for stand uniformity and yields will be reduced. Care must be taken to properly calibrate and, if needed, to overlap swaths with the airplane or spinner spreader.

Broadcast small grain seed should be incorporated with tillage equipment that will result in shallow, uniform burial of the seed. Disks and field cultivators should be set to cut not more than about 3 inches in depth. Stands planted broadcast and incorporated result in poorer, less uniform stands than those planted with a drill. Seeding rates should be increased about 50% over what would normally be used in drill planting to compensate. Part of the reason for poor stands with broadcast planting can be attributed to the lack of uniform planting depth. The incorporation process results in part of the seed being incorporated excessively deep, and part too shallow. The lack of good seed-to-soil contact associated with fluffy or cloddy seedbeds is also a cause of stand failure. Better stands are achieved when planting is immediately followed by rainfall, and in those seedbeds where uniform, shallow incorporation is achieved. Broadcast seeding is generally only practiced in irrigated wheat or in the areas of the state with 30+ inches of annual rainfall, and a good probability of rainfall following seeding. It is estimated that in excess of 90% of the Texas small grain acreage is planted with drills due to the greater success in achieving acceptable stands.

Occasionally, good stands are achieved by broadcasting seed upon a prepared seedbed without incorporation, but the probability of success improves significantly with incorporation. Fall broadcasting of seed into perennial summer pastures without seedbed preparation has little chance of success and is not recommended.

Stands of small grains planted by broadcast methods will be improved by the use of a roller or cultipacker following incorporating tillage to firm up the seedbed. This operation improves seed-to-soil contact and enhances the ability of the seed to imbibe adequate moisture for germination.

Small grains are frequently planted following corn or sorghum. Be sure to evaluate potential for residual herbicide injury to small grains from herbicides such as atrazine, propazine, Pursuit or Exceed which may have been applied to the corn or sorghum crop. Check labels of herbicides applied to corn or sorghum for fallow crop restrictions. Studies conducted at Bushland indicates that some wheat varieties have more tolerance to atrazine residue than do others.

When double cropping small grains following grain crops such as corn or sorghum, residue management plays a key role in stand establishment. Small grain seedlings do not compete well for light. When planting in a field with heave crop residues, consider burning to destroy residue, or tillage to thoroughly incorporate residue into the soil. This is particularly important in irrigated production in the Northern High Plains where feed grain harvest is immediately followed by small grains planting.

When drill planting small grains, several steps can be taken to improve the percentage of seed that emerge. The variable most likely to reduce emergence is planting too deep. The depth from which a wheat (or other small grain seed) will emerge is regulated by coleoptile length, seed vigor and seedbed conditions such as temperature, moisture, soil borne pathogens and soil conditions such as crusting. The coleoptile is the shoot which emerges from the seed to pierce the soil surface. If the coleoptile is unable to pierce through the soil surface due to a combination of the above conditions, stand failure occurs.

Potential coleoptile length is genetically regulated. As a rule, the semidwarf or short wheat varieties have a much shorter coleoptiles than do tall or conventional height wheat. Most wheat planted in Texas is semidwarf, as grain yield potentials are higher with these varieties. Tall wheats may have coleoptiles one inch or more longer than semidwarfs, but there is variability between varieties within a height class.

Another variable with a great impact upon coleoptile length is soil temperature. The optimum temperature for the growth of wheat is about 70°F. If wheat is planted in soils higher or lower than this temperature, coleoptile length is proportionally reduced. It is estimated that coleoptile length of seed planted in soils at 90°F or at 45° F would be only about half the length of wheat sewn at 70°F.

Seedling vigor plays a major role in the ability of seed to germinate in field conditions. Vigor encompasses a number of variables related to the conditions under which the seed was produced and stored. Perhaps most important is seed size. Large, plump, high test weight seed has greater vigor and more energy stored within the seed than does smaller, shriveled or lower test weight seed of the same variety. Seed with high vigor performs better under adverse field conditions than seed of the same germination percentage with low vigor. Standard germination tests are conducted at near optimum conditions. These conditions are not necessarily reflective of field conditions which might include plant disease, soil crusting, high or low temperatures, etc., and are not necessarily a good indication of seedling vigor.

Optimum depth for wheat (and most other small grains) seeding under very favorable conditions is about 1.5 inches. Optimum planting depth for under very warm or cool conditions is 1.0 inch or even less. The realistic depth for optimum planting varies with planting conditions. In much of Texas, late August through mid-September is a time of high rainfall probability. If wheat for forage production or dual purpose use is planted into good soil moisture at this time of the year, shallow planting is best. October through November tend to be very dry in much of the wheat planting area of the state. If deep planting cannot be avoided due to lack of surface moisture, seek wheat seed with a long coleoptile, and large, plump seed with good test weight for that variety.

Most wheat planted during October and November is drilled into soils with a dry surface but adequate germinating moisture at depth. As soils are cooler, wheat can tolerate deeper planting, but great care should be taken in regulating planting depth. Even at this time of the year, wheat planted over 2.5 inches deep is not likely to achieve a good stand. Many farmers and ranchers employ the practice of plowing or disking wheat fields following September rains and immediately before planting. This practice leaves a fluffy seedbed which makes it extremely difficult to control seeding depth with most drills. Drills with depth bands on double disc openers are perhaps the only conventional drills that can effectively regulate seeding depth in loose seedbeds. A better practice is to control volunteer wheat and weeds with chemicals and to plant in a firm, stale seedbed. Leaving a significant amount of crop residue on the surface will reduce crusting, which is the reason for many of these preplant tillage operations.

Air drills can reduce some of the problems associated with land preparation and preplant tillage. Depth regulation is achieved by dropping seed behind small sweeps. These sweeps can achieve weed and volunteer control during the planting operation. When properly equipped, they can, like conventional no-till drills, operate in fields with a large amount of crop residue on the surface.

Soil crusting is a major problem with small grain emergence. Crusting is greatest in sandy soils, and is somewhat less of a concern in soils with clay texture. Clean tillage, particularly in sandy soils or other soils without strong structure, sets up conditions for severe crusting if planting is followed by high intensity rainfall. Impact of raindrops on a bare soil surface is a cause of crusting. Dense crusts on the soil surface further limit the depth from which seed can emerge. Even if uniform planting is achieved at a suitable depth for environmental conditions, the emerging coleoptile requires a great deal of energy to penetrate a soil crust. Seed with less than optimum vigor may not achieve a stand under these conditions. Management practices to reduce damage from crusting include high residue farming such as no-till or conservation tillage and stale seed bed planting with chemical fallow.

Soil borne plant pathogens such as “take all”, dryland foot rot, and others are active in warm, moist soils, particularly those repeatedly cropped to wheat. *Pythium* can be particularly damaging under cool, moist conditions at germination. Good systemic seed treatment fungicides reduce the damage caused by these seedling diseases. Conditions under which favorable response to systemic seed treatment fungicides might be expected include early or late planting, use of lower vigor or test weight seed, deep planting, and planting in fields after multiple years of monocropping small grains. One seed treatment, Baytan, is considered a growth regulator. Baytan treated seed is known to result in a shortened subcrown internode, and treated seed will not emerge consistently when deep planted. Fungicidal seed treatments are less important to emergence when high quality seed is planted under optimum conditions, however optimum planting conditions rarely occur when small grains.

Optimum plant population is dependent upon weather and environmental conditions. There is little difference between species with respect to population needs. Given differences in weight per bushel and seed size between varieties, it is best to evaluate stand based on plant density, or plants per square foot. In the drier climates of Texas, 10 plants per square foot is considered adequate, whereas under high yield conditions or in management situations where early forage production is important, best results can be obtained by seeding rates resulting in 25 plants per square foot. Under typical wheat planting conditions with high quality seed, emergence is typically 50- to 80% of the seed number planted. This percentage can be substantially increased by careful attention to planting depth, coleoptile length, seed quality and soil temperatures. Table 1 gives a range of seeding rates and seed size required to achieve an adequate stand of small grains.

Annual ryegrass establishment

Annual ryegrass is the most widely used cool season grass for winter pasture in the high rainfall regions of the state. When properly established, ryegrass can approach small grain pastures in both fall and winter forage yield. Where ryegrass is best adapted, it has superior spring forage yields to all of the small grain species. Ryegrass is best adapted to high rainfall conditions, and is more tolerant of wet, flooded conditions than are small grains, particularly barley, rye and triticale. Ryegrass has a much smaller seed than small grains, and as a consequence should be planted differently. Optimum conditions to obtain a good stand of ryegrass would be to broadcast seed on a prepared seedbed, and to follow this with very shallow incorporation using a harrow or drag. Good stands can also be obtained by directly overseeding permanent warm season pastures. Stands are improved by a light tillage operation with a disc or pasture renovator prior to broadcasting. Care should be taken to reduce early competition from the warm season pasture by either flash grazing or mowing to less than 1 inch in height prior to seeding, as stands can be damaged if direct light is not available to the germinating seedling.

Ryegrass has a small seed with only a fraction of the energy available in small grains. Given this property, care should be taken not to bury seed more than 0.5- to 0.75 inches in depth. Never mix ryegrass with small grain seed for drill planting. In lieu of the drill box mixture, broadcast ryegrass seed ahead of drill planting. Soil disturbance by a grain drill is adequate incorporation for ryegrass seed, should a mixed stand be desired. Because stands cannot be achieved from deep buried seed, ryegrass in more vulnerable to stand failure when light rain showers wet the seedbed, but are followed by hot, dry weather.

Best fall forage production will be available by planting high seeding rates in prepared seedbed. Avoid planting in high temperatures common to Texas before mid-September. Consider seeding at the 30 pound per acre rate where early forage production is essential. When overseeding warm season perennial pasture with the goal of late winter and spring grazing, 10- to 15 pounds of seed per acre are adequate. Ryegrass tillers profusely, and a light stand can produce good forage yields in the spring despite poor fall production. To achieve fall forage yields approaching those of small grains, dense stands must be obtained in the fall.

Table 1. Seed rate to achieve a desired stand in small grains

Seed per pound	Percent Emergence 90%	80%	70%	60%	50%
Desired Plant Population: 10 plants/sq. ft/ (435,600/acre)					
18000	27	30	35	40	48
16000	30	34	39	45	54
12000	40	45	52	61	73
Desired Plant Population: 15 plants/sq. ft/ (653,400/acre)					
18000	40	45	52	61	73
16000	45	51	58	68	82
12000	61	68	78	91	109
Desired Plant Population: 20 plants/sq. ft/ (871,200/acre)					
18000	54	61	69	81	97
16000	61	68	78	91	109
12000	81	91	104	121	145
Desired Plant Population: 25 plants/sq. ft/ (1,089,000/acre)					
18000	67	76	86	101	121
16000	76	85	97	113	136
12000	101	113	130	151	182

Additional information and publications can be found on the Web at:
http://taexsoilcrop.tamu.edu